

Appendix C

Specifications

ISB Construction Specification

Facility Package for the Test Area North Operable Unit 1-07B In Situ Bioremediation Facility

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

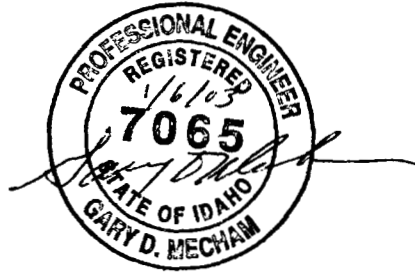


Form 412.14
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10. Is this a Construction Specification? Yes ☒ No ☐ 11. NCR Related? Yes ☐ No ☒
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Project Title: Facility Package for the Test Area North OU 1-07B In Situ
Bioremediation Facility
Document Type: Construction Specification
Revision Number: 0

The following Sections of this Specification were prepared under the direction of the Professional Engineer as indicated by the seal and signature provided on this page. The Professional Engineer is registered in the State of Idaho to practice Mechanical Engineering.



Division 1 – General Requirements

01005 – Summary of Work

Division 13 – Special Construction

13122 – Prefabricated Fiberglass Shelters

13400 – Instruments and Equipment

Division 15 – Mechanical

15025 – Welding

15404 – Piping and Plumbing

15405 – Underground Injection and Potable Water Piping

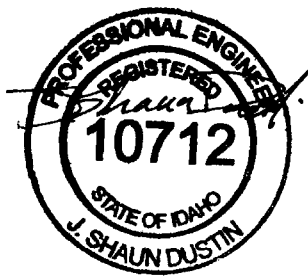
15508 – Bulk Bag Unloader

15509 – Eductor

15802 – HVAC/Ductwork

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Division 2 – Site Work

02200 – Earthwork
02722 – Sanitary Sewer Piping

Division 3 – Concrete

03300 – Cast-in-Place Concrete

Division 5 – Metals

05100 – Structural Steel and Miscellaneous Metals

Division 7 – Thermal and Moisture Protection

07190 – Vapor Barriers
07200 – Thermal Insulation
07901 – Joint Sealants

Division 8 – Doors and Windows

08110 – Steel Doors and Frames
08362 – Insulated Overhead Door
08521 – Aluminum Hung Windows
08700 – Door Hardware

Division 9 – Finishes

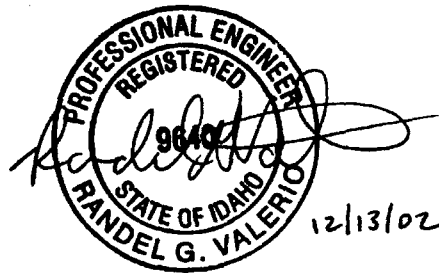
09250 – Gypsum Drywall
09900 – Painting

Division 13 – Special Construction

13120 – Metal Building Systems
13121 – Mezzanine

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Division 16 – Electrical

- 16000 – General Electrical Provisions
- 16109 – Switches, Receptacles, and Wall Plates
- 16110 – Electrical Raceways
- 16120 – Cable, Wire, Connectors, and Miscellaneous Devices
- 16160 – Panelboards
- 16195 – Electrical Identification
- 16360 – Disconnect Switches
- 16450 – Grounding
- 16460 – Transformers, General Lighting, and Distribution Dry Type, Indoor and Outdoor, Under 600V
- 16500 – Lighting

Project Title: **ISB Injection System**
Section Title: **Summary of Work**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

SECTION 01005--SUMMARY OF WORK

PART 1--GENERAL

SUMMARY:

The Subcontractor shall furnish plant, labor, material, equipment, and supplies (except government-furnished materials [GFM] and/or equipment) and perform work and operations necessary to construct the complete In Situ Bioremediation (ISB) Injection System with associated yard piping; structures; heating, ventilation, and air conditioning (HVAC); and mechanical equipment and utilities, in accordance with the subcontract drawings and these specifications.

Section Includes: Work includes, but is not limited to:

Earthwork: As specified in Section 02200 including excavation for building foundation, buried piping and utilities, backfilling of all excavation for footings, foundations, pipe and utility trenches, installing all locator ribbon, compacting all backfill, and finish grading for surface drainage. Also includes excavation and installation of septic sewer system, as specified in Section 02722.

Cast-in-Place Concrete: As specified in Section 03300 including furnishing and installing concrete and steel, reinforcing materials for the building foundation and flooring, and concrete around buried conduit and exterior pads.

Buildings: Furnish design services, shop drawings, labor, material, equipment, and supplies and perform work and operations necessary to construct the complete ISB Injection System building in accordance with the subcontract drawings and specifications including Section 05100, "Structural Steel & Miscellaneous Metals;" Section 07190, "Vapor Barriers;" Section 07200, "Thermal Insulation;" Section 07901, "Joint Sealants;" Section 08110, "Steel Doors and Frames;" Section 08362, "Insulated Overhead Door;" Section 08700, "Door Hardware;" Section 09250, "Gypsum Drywall;" Section 09900, "Painting;" Section 13120, "Metal Building Systems;" and Section 13121, "Mezzanine."

Electrical: Furnish labor, material, equipment, and supplies; install and test lines from the 3-phase transformers on Pole 51-10 to the ISB injection building and all electrical equipment and apparatuses for the building, electrical for mechanical equipment located in the building, electrical supply to the CERCLA Waste Storage Area (CWSU) and ISB Injection SEAVAN, conduit supports, wiring, lighting, and all other electrical, as shown on the subcontract drawings and specified in the 16000 series sections.

Instrumentation: As specified in Section 13400, "Instruments and Equipment," including instrumentation for all mechanical equipment located in the ISB injection building.

Piping: Furnish and install all valves, valve tags, tubing, instruments, gauges, mounting brackets, pipe, flanges, fittings, couplings, strainers, hangers, supports, and appurtenances as required to complete the work and as shown on the subcontract drawings for the piping and instrumentation within the ISB injection building and yard piping including tie-ins to existing pipe lines. Work includes all pipe welding and pipe support welding. Yard piping also includes all buried piping to wells, buried fire water/potable water piping, potable water piping, well "down hole" piping, etc. unless noted "by others" in the specifications or as shown on the drawings. Work includes all cleaning, testing, flushing, and sterilizing of the piping systems, as specified herein and in related 15000 series sections.

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Mechanical Equipment: Furnish, install, and test all pumps as shown on the drawings; furnish, install, and test bulk bag unloader, Section 15508, and eductor, Section 15509.

HVAC: As specified in Section 15802, "HVAC/Ductwork," including all heaters, exhausters, Louvers, ductwork, and duct supports.

RELATED SECTIONS:

Section 02200 – "Earthwork"
Section 02722 – "Sanitary Sewer Piping"
Section 03300 – "Cast-in-Place Concrete"
Section 05100 – "Structural Steel & Miscellaneous Metals"
Section 07190 – "Vapor Barriers"
Section 07200 – "Thermal Insulation"
Section 07901 – "Joint Sealants"
Section 08110 – "Steel Doors and Frames"
Section 08521 – "Aluminum Hung Windows"
Section 08362 – "Insulated Overhead Door"
Section 08700 – "Door Hardware"
Section 09250 – "Gypsum Drywall"
Section 09900 – "Painting"
Section 13120 – "Metal Building Systems"
Section 13121 – "Mezzanine"
Section 13122 – "Prefabricated Fiberglass Shelters"
Section 13400 – "Instruments and Equipment"
Section 15025 – "Welding"
Section 15404 – "Piping and Plumbing"
Section 15405 – "Underground Injection and Potable Water Piping"
Section 15508 – "Bulk Bag Unloader"
Section 15509 – "Eductor"
Section 15802 – "HVAC/Ductwork"
Section 16000 – "Electrical General Provisions"
Section 16109 – "Switches, Receptacles, and Wall Plates"
Section 16110 – "Electrical Raceways"
Section 16120 – "Cable, Wire, Connectors, and Miscellaneous Devices"
Section 16160 – "Panel boards"
Section 16195 – "Electrical Identification"
Section 16360 – "Disconnect Switches"
Section 16450 – "Grounding"
Section 16460 – "Transformers, General Lighting, and Distribution Dry Type, Indoor and Outdoor, Under 600V"
Section 16500 – "Lighting"

REFERENCES:

The following documents, including others referenced therein, form part of this section to the extent designated herein.

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CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910 "Occupational Safety and Health Standards"
29 CFR 1926 "Safety and Health Regulations for Construction"

Bechtel BWXT Idaho, LLC (BBWI)

Construction Management Environmental, Health and Safety Requirements

Unless otherwise specified, references in these specifications or on the subcontract drawings to other specifications, codes, standards or manuals that are part of these specifications, but are not included herein, shall be the latest edition, including any amendments and revisions, in effect as of the date of this specification.

SUBMITTALS: Submittals are listed in the related sections and vendor data schedule and include, but are not limited to, the following:

Shop Drawings and Vendor Data: The Subcontractor shall submit copies of shop drawings and vendors' data, as required by the Vendor Data Schedule and specification sections for materials and equipment to be furnished by the Subcontractor. When the Subcontractor proposes an "equal" item, data shall be submitted to the Contractor in such detail to clearly illustrate that the item, including components and fabrication thereof, or that adjustment of features to make the item "equal", meets requirements of the subcontract drawings and specifications. The Subcontractor shall submit data for "equal" approval and obtain the Contractor's approval before committing to purchase the proposed "equal" item.

Manufacturers' Operation and Maintenance Manuals: The Subcontractor shall furnish a minimum of six copies (unless additional copies are required in the Vendor Data Schedule) of installation, operating and maintenance manuals, for operating equipment and systems, as required by the Vendor Data Schedule and specification sections. The manufacturers of the operating equipment or systems furnished and installed under these specifications shall prepare the manuals.

Manuals shall be complete and shall include instructions and sufficient data for lubricating, startup sequence, operating instructions, special test procedures or instructions recommended by the manufacturer, maintenance procedures, a complete parts list, and recommended list of spare parts for normal expected maintenance. Wiring diagrams shall be furnished for electrically operated equipment.

The required number of manuals shall be furnished to the Contractor within 30 calendar days after final shop drawings or the Subcontractor has obtained vendor data approval.

Hazardous Chemicals and Substances: Subcontractor shall submit a Chemical Inventory List (Form 432.21) for mandatory approval. Chemicals and substances not previously approved for use will require the submittal of a material safety data sheet (MSDS) for mandatory approval.

See the Vendor Data Schedule for additional submittal requirements.

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1 **QUALITY ASSURANCE:**

2
3 Quality Assurance Program requirements shall exist to ensure that work performed is in conformance
4 with the requirements established by the drawings and this specification. The subcontractors approved
5 Quality Assurance Program and/or plan shall be implemented as indicated on Form 540.10, "Safety
6 Checklist of Subcontractor Requirements for On-Site Nonconstruction Work," and as applicable to the
7 contract scope of work.

8
9 **Standard Products:** The materials and equipment furnished by the Subcontractor shall be standard
10 products of manufacturers regularly engaged in the production of the type of materials and equipment
11 required and shall be of the manufacturer's latest standard designs. Where two or more units of the same
12 type and class of material or equipment are required, the units shall be the product of the same
13 manufacturer and shall be identical insofar as possible. The component parts of a unit of equipment need
14 not be the products of the manufacturer.

15
16 **Repair of Damages:**

17
18 **General:** Construction materials and equipment, flange facings, threads, machined or painted, and other
19 exposed finished surfaces shall be protected from damage at all times during shipping, handling,
20 construction and installation. Materials and equipment repaired or replaced by the Subcontractor shall be
21 subject to acceptance by the Contractor.

22
23 **SAFETY, HEALTH, AND ENVIRONMENT:**

24
25 In general, work shall be in compliance with the applicable sections of 29 CFR 1910, 29 CFR 1926, and
26 the INEEL Construction Management environmental, health, and safety requirements.

27
28 **DELIVERY, STORAGE, AND HANDLING**

29
30 All materials normally packaged shall be delivered to the site in the original, unopened packages with
31 labels intact. Upon arrival, the Subcontractor shall inspect the materials or equipment for damage.

32
33 Materials and equipment shall be stored and handled in accordance with the manufacturer's instructions.

34
35 **PART 2--PRODUCTS**

36
37 **MATERIALS:**

38
39 **New Materials and Equipment:** Materials and equipment received by the Subcontractor in a damaged
40 condition shall be repaired or replaced by the Subcontractor as directed by the Contractor. Materials and
41 equipment damaged by the Subcontractor shall be repaired or replaced by the Subcontractor.

42
43 **Existing Materials, Equipment, and Structures:** Existing materials, equipment, and structures—including
44 paint and protective coatings—involved under this Subcontract shall be thoroughly inspected by the
45 Subcontractor before starting any work. Any defects or damages, the repair of which are not covered
46 under these specifications or subcontract drawings, shall be reported in writing to the Contractor by the
47 Subcontractor. The Subcontractor shall place reinstalled operating equipment in an operating condition
48 that is at least as good as it was at the time the Subcontractor started work.

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GFM: There is no planned GFM for this subcontract.

Hazardous Chemicals and Substances: The Subcontractor shall comply with applicable requirements of 29 CFR 1926.59, "Hazard Communication."

Specialty Items:

SP-103, Powder handling system (ref. Section 15508)
SP-104, Backflow preventer (Watts International, Series 009 M2QT)
SP-105, Vacuum breaker (Conbraco Series 90-500)
SP-108, Deionized water equipment (Barnstead D0800)
SP-109, Flammable cabinet (Justrite 25720)
SP-110, Fume hood (Labconco 28048-00)
SP-111, Acid cabinet (Labconco 35820-00)

PART 3--CONSTRUCTION AND INSTALLATION

General: Materials and equipment shall be erected or installed only by qualified personnel who are regularly engaged in the trades required to complete the work. The subcontract drawings show the general arrangement and space allocation of the equipment specified. It shall be the Subcontractor's responsibility to verify changes in conditions or rearrangements necessary because of substitutions for specified materials or equipment and to coordinate interface between lab/office and metal building systems. Where rearrangements are necessary, the Subcontractor shall prepare and submit drawings of the proposed rearrangement for approval before construction or installation.

Coordination of Work: Where new work and existing facilities are shown on the drawings, but are not located precisely by dimensions, the Subcontractor shall be responsible for proper location and clearances and for correcting discrepancies and interferences in the work, which are a result of Subcontractor operations. Work done by one trade that must be integrated with work of other trades shall be laid out with due regard to the work done, or to be done, by other trades; particularly if the work done by one trade depends upon completion or proper installation of work done by other trades. The Subcontractor shall cooperate in coordinating his work with work being done by others if their work must be integrated with the Subcontractor's work. The Subcontractor shall notify the Contractor at least 1 week prior to starting of the date on which the Subcontractor proposes to proceed with the work.

Subsurface Investigation: Prior to any excavation activities, the subcontractor shall obtain written approval by completing and submitting an outage request in accordance with the General Provisions. In addition, the contractor will perform a subsurface investigation to determine the location of buried utilities and piping. The subcontractor will be required to comply with all contractor and Occupational Safety and Health Administration (OSHA) requirements during excavation activities, and hand excavation will be required in the vicinity of buried items in accordance with the General Provisions.

Workmanship: Work shall be done in a skillful and workmanlike manner. The Subcontractor shall do structural cutting, fitting, patching, repairing and associated work necessary for installation of equipment, piping, and electrical conduits, etc. No major cuts or holes, not shown on the drawings, shall be made without prior approval of the Contractor. After the equipment and/or piping are installed, exposed holes, cracks, and other defects shall be neatly patched and the patched areas shall match the adjoining materials and finish.

END OF SECTION 01005

Project Title: **ISB Injection System**
Section Title: **Prefabricated Fiberglass Shelters**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

SECTION 13122--PREFABRICATED FIBERGLASS SHELTERS

PART 1--GENERAL

SUMMARY:

The Subcontractor shall supply all labor, equipment, and materials required to construct items listed hereafter and as shown on the drawings.

Section Includes: Work includes, but is not limited to:

Supply and installation of prefabricated fiberglass well house structures.

Related Sections: The following sections contain requirements that relate to the work of this section:

Section 03300, "Cast-In-Place Concrete," for grouting and cast-in-place anchoring structural steel and miscellaneous metals to concrete
Section 05100, "Structural Steel and Miscellaneous Metals," for embedded anchors
Section 07901, "Joint Sealants"
Section 08700, "Door Hardware"
Section 15405, "Underground Injection and Potable Water Piping"
Section 16000, "General Electrical Provisions."

REFERENCES:

The following documents, including others referenced therein, form part of this section to the extent designated herein.

INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

IBC *International Building Code*

SUBMITTALS:

Unless otherwise noted, submittals shall be made prior to construction start.

Shop Drawings: Submit shop drawings prior to procurement that completely detail doors, attachment flanges, anchor bolts, anchor bolt sizes, embedment depths and locations, floor rack support embedment depths and locations, lifting eye locations, wall base conditions including base-mounting flange, and any other graphic information required to evaluate the complete structures including all dimensions. Shop drawings shall conform to the results of the design calculations.

Design Calculations: Submit design calculations with shop drawings showing all loads specified. A Registered Professional Structural Engineer shall stamp all design calculations.

Warranties: Before final acceptance, submit sample warranties for approval prior to procurement. Submit three copies of executed warranties for information to Contractor's Representative before final acceptance of the project.

Project Title: **ISB Injection System**
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Revision Number: 0

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Installation: Prior to installation, submit copies of offloading and installation plans for approval. The installation plan shall describe all necessary temporary supports, including the sequence of installation and removal. Plan shall show sufficient detail and instructions to ensure that the structure has been evaluated for stability throughout the contract.

Materials: Submit copies of certified copies of mill test reports for anchor bolts, heavy-hex nuts, and flat washers for approval prior to purchase. Submit copies of test reports and material properties for fiberglass laminates.

Procedures: Submit copies of procedures for tightening of flange bolts for approval prior to purchase. The procedure shall include necessary materials, tightening methods, and inspection methods or criteria.

Samples: Submit three anchor bolt, nut, and washer assemblies for attachment to the well house flange from each lot supplied for examination, testing, and approval by the Contractor prior to installation. Submit three samples of the fiberglass wall laminate section (6 × 6-in. minimum) for examination, testing, and approval by the Contractor prior to installation.

Certification: Submit certification that well houses and accessories have been installed in accordance with the manufacturer's specifications.

Submittals for Information: None.

Submittals for Project Closeout: None.

QUALITY CONTROL:

Qualifications: Provide prefabricated fiberglass buildings that are produced by a manufacturer who is regularly engaged in fabrication of pre-engineered fiberglass structures of type and quality indicated. All components shall be provided and installed by the building system manufacturer at the manufacturing facility.

WARRANTIES:

The fiberglass shelter—including the door, hinges, fan, louvers, and hardware—shall be warranted for a minimum of 10 years against ultraviolet (UV) damage, leakage, de-lamination, and rusting. Warranty shall include labor and materials for replacement of defective materials. Warranty shall not be pro-rated over a 10-year period.

DELIVERY, STORAGE, AND HANDLING:

Store material to permit easy access for inspection and identification. Protect members and materials from corrosion and deterioration.

Do not store materials in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials that do not meet these specifications.

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Section Title: **Prefabricated Fiberglass Shelters**
Revision Number: 0

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Revision Date: 01/23/03

1 PART 2--PRODUCTS

2
3 MATERIALS:

4
5 Fiberglass Laminate: Walls, door, and roof shall be of sandwich construction consisting of UV-stabilized
6 1/8-in. minimum thickness fiberglass skins and 1-in. minimum thickness rigid foam core (minimum
7 R-value = 10.0).

8
9 Door: The door shall provide a clear opening of not less than 2 ft, 6 in. wide × 6 ft high. Mounting,
10 latching, and locking hardware shall meet the standard of quality specified in Section 08700, "Door
11 Hardware." The door shall provide a weather-tight seal on all four edges.

12
13 Anchor Bolts: ASTM A307, "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
14 Strength."

15
16 Lifting Lugs: Stainless steel, minimum 2-in. diameter inside dimension.

17
18 Concrete Anchors: Concrete anchors for the structural flange shall be cast-in-place bolts, sized as
19 indicated in the shop drawings. For pipe and equipment supports, use wedge anchors as manufactured by
20 one of the following manufacturers or approved equal:

21
22 "Red Head" by ITT Phillips Drill Company
23 "Hilti Kwik-Bolt II" by Hilti Inc.

24
25 Compressible Seals: Closed-cell neoprene or ethylene propylene diene terpolymer (EPDM) strips or
26 sheet, of size as indicated, with compatible adhesive joint sealant.

27
28 Dimensions: Subcontractor is responsible for ensuring that well houses fit the existing concrete
29 foundation and bolt spacing at Technical Support Facility-05 (TSF-05) and the new foundations provided
30 by the Subcontractor.

31
32 Downhole Rack Support Inserts: Unistrut P3743-12 or approved equal.

33
34 EQUIPMENT:

35
36 Heater: The shelter shall be equipped with a 1,500-W, 120-V Underwriters Laboratory-listed heater with
37 an integral thermostat on/off switch.

38
39 Electrical: The shelter shall be equipped with a 125A main lug 8-branch circuit panel in a NEMA 3R
40 thermoplastic enclosure. Three each 15-amp breakers shall be provided. Two 120-V GFI duplex outlets
41 shall be provided. Interior lighting shall be provided by a 60-W vapor-resistant incandescent lamp. The
42 shelter shall be pre-wired with 12-ga wiring in UL-listed nonmetallic conduit. A weatherproof switch for
43 the fan and the lamp shall be provided, as shown in the drawings.

44
45 Instrumentation Support: Provide mounting provisions laminated into back wall of structure and Unistrut
46 P3743-12 or equal inserts, as shown in the plans for supporting rack for down-hole instruments.

47
48 Ventilation: The shelter shall be provided with a switch-controlled screened fan having a free air capacity
49 of 150 ft³/min. The fan shall be mounted high in the shelter and as shown in the drawings. The fan shall

Project Title: **ISB Injection System**
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be covered with an exterior shroud. The shelter shall be provided with a 12-in. square louver located opposite the fan and low on the wall.

DESIGN LOADS:

The building shall be designed to comply with the requirements of IBC Section 312. Apply the following loads in addition to dead load:

Vertical Live Loads: A 30-psf snow load with an allowance for ice buildup at the eaves, if applicable.

Wind Loads: The wind load on the structure shall be designed for an 80-mph wind speed, calculated according to the UBC exposure Class "C."

Seismic Loads: Seismic loads shall be determined and applied in accordance with the UBC Zone 2b.

FABRICATION:

Shop Fabrication and Assembly: Fabrication and assembly shall be done in the shop to the maximum extent possible.

PART 3--EXECUTION

INSTALLATION:

Surveys: Check elevations of concrete-bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds, and report discrepancies to the Contractor. Do not proceed with erection until corrections have been made or until compensating adjustments have been agreed upon with the Contractor.

Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.

Anchor Bolts and Rack Support Inserts: Furnish anchor bolts and other connectors required for securing steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts, anchors, and inserts to accurate locations.

Field/Shop Assembly: Set structures accurately to lines and elevations indicated. Align and adjust various members before permanently fastening. Clean the surfaces that will be in contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

Pipe Penetrations: For pipe and conduit penetrations through the roof and walls, use a "DEKTITE" pipe-flashing unit as manufactured by ITW Buildex or approved equal. Provide a stainless-steel hose clamp for positive sealing of flashing to pipe. Field penetrations shall be cut with a tool designed for the purpose of cutting round openings. Rough edges shall be sanded to remove loose material and provide a smooth finish.

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Section Title: **Prefabricated Fiberglass Shelters**
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1 FIELD QUALITY CONTROL:

2

3 Contractor Inspection: The Contractor's Representative will perform surveillance to verify compliance of
4 the work to the drawing and specifications.

5

6 END OF SECTION 13122

Project Title: **ISB Injection System**
Section Title: **Instruments and Equipment**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

SECTION 13400--INSTRUMENTS AND EQUIPMENT

PART 1---GENERAL

WORK DESCRIPTION:

The Subcontractor shall provide all instrumentation and controls, as specified in the design drawings for the ISB System and ensure that all performance requirements are met.

Section Includes:

The Subcontractor shall provide the following instrumentation and controls for the ISB System including, but not limited to:

1. Flow meters
2. Pressure gauges
3. Pressure switch.

RELATED SECTIONS:

Section 16000 – “Electrical General Provisions”

SYSTEM DESCRIPTION:

General Design Requirements: A description of the design and performance requirements for the instrumentation equipment is contained in the specified attachments.

Electronic analog transmitters and receivers shall have their input and output signals isolated from ground.

QUALITY CONTROL:

Codes and Standards: The following standards and criteria (latest edition) shall be used, where applicable, in the design of the building covered by this specification.

American Society of Mechanical Engineers (ASME):
ASME B16.5-88/B16.5A-92 “Pipe Flanges and Flanged Fittings”

American Society for Testing and Materials (ASTM):
ASTM A105/A105M-96 “Standard Specification for Carbon Steel Forgings for Piping Applications”

National Fire Protection Association (NFPA):
NFPA 70-96 National Electrical Code, 1996 Edition

National Electric Manufacturing Association (NEMA):

Project Title: **ISB Injection System**
Section Title: **Instruments and Equipment**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

NEMA ICS 6-93

Enclosures for Industrial Control and Systems; Revision 1 -
March 1989.

General:

Instrumentation equipment shall be new, industrial type, and of the function and type specified in Part 2.

Instrumentation equipment provided shall be compatible with the intended service. Instrument equipment shall be calibrated to the manufacturer's standards. Test equipment shall be calibrated and shall be traceable by tag number, make, and model number.

Manufacturers' Qualifications: Manufacturers shall have 5 years of verifiable experience in the production of instrumentation equipment of the same type and similar performance as that specified herein.

Instrument equipment shall be calibrated in accordance with the manufacturer's recommendations.

SUBMITTALS FOR REVIEW:

Product Data:

Provide catalog "cut sheets," data sheets, wiring diagrams, and flow characteristic curves prior to procurement.

SUBMITTALS FOR INFORMATION:

Installation instructions, including recommended calibration procedures and installation details. Include frequency of calibration required at the time after system installation and regular intervals of time thereafter.

SUBMITTALS AT PROJECT CLOSEOUT:

Provide test and calibration reports listing equipment used, person or persons performing the tests, date tested, device or circuit tested, and results of test.

Provide operations and maintenance (O&M) manuals.

Identify preventive maintenance activities, as recommended by the manufacturer. Include maintenance service telephone numbers and information along with product documentation.

Submit manufacturer's warranty and ensure that forms have been filled out in owner's name and registered with manufacturer.

DELIVERY, STORAGE, HANDLING, AND SHIPPING:

Product shipping container(s) shall contain packing materials to prevent the entrance of water to instrument surfaces, interior, and exterior. Product shipping container(s) shall be clearly marked

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"FRAGILE - DO NOT DROP," and shall be furnished with an itemized invoice stating the contents and quantity of products contained therein.

PROJECT CONDITIONS:

The INEEL is located near Idaho Falls, Idaho—approximately 4,900 ft above sea level. Ambient temperature range is from -20 to 100°F, with a barometric pressure of approximately 29.0 in. Hg absolute (mean at 70°F). Relative humidity varies from 20 to 95%.

Electrical supply for instruments, unless otherwise noted, shall be 120 V, single phase, 60 Hz.

MAINTENANCE:

The Subcontractor must provide any extra/replacement parts or materials required to maintain acceptable product performance up to the time in which acceptance testing is complete.

PART 2---PRODUCTS

INSTRUMENTATION:

Flow Meters (See Attachment A.)

Flow meters will consist of a flow element and flow indicator. The flow elements shall be an electromagnetic type for liquid flow before and after nutrient injection, a direct-read type at the eductor, and a coriolis type for hi-viscosity fluid flow. The electromagnetic and coriolis types will have an integral indicator mounted in the vicinity of the flow element and shall display both flow rate and total flow with a digital display of eight digits. Scale shall be in gallons per minute (gpm) for flow rate and in gallons or gallons multiplied by a power of 10 for total flow.

Pressure Gauges (See Attachment B.)

Pressure elements shall be bourdon tube or diaphragm. Elements in contact with the process shall be manufactured from material suitable for specific process application. Gauge shall have a 4-1/2-in. dial, 1/2-in. threaded connection. All gauges shall be vibration and shock resistant. Scale shall be selected so that normal operating range is between 33 and 67% of span.

Pressure Switch (See Attachment C.)

Pressure switch shall be bourdon tube type. Elements in contact with the process shall be manufactured from material suitable for specific process application. Switch shall have 1/4-in. threaded connection. The switch shall be vibration and shock resistant. Scale shall be selected so that false signals are not sent during normal operating conditions.

PART 3---EXECUTION

CLEANING:

Instruments shall be cleaned in accordance with the manufacturer's recommended cleaning procedures. After cleaning, work shall be free from contamination with no residual contaminants present that could

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ATTACHMENTS:

ATTACHMENT A:

The following flow meter data sheets are attached:

1. R200 coriolis flow meters
2. 8711 electromagnetic flow meters
3. 8700 flow meter transmitters

ATTACHMENT B:

The following pressure gauge data sheets are attached:


1. Pressure gauges, Ashcroft, or equal

ATTACHMENT C:

The following pressure switch data sheets are attached:

1. Pressure switch, Dwyer, or equal


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REQUISITION NO.				VENDOR			
1	Loop Tag No.	FI 1		FI 2		FI 3	
2	Item No.	FI 1		FI 2		FI 3	
3	Manufacturer/Model No.	Emerson		Emerson		Micro Motion	
		8711THE015U1N0 TUBE		8711THE015U1N0 TUBE		R200S341NCAAE ZZZZ SENSOR	
		8732CT12N0M4T1 XMTR		8732CT12N0M4T1 XMTR		1700I11ABAEZZZ XMTR	
4	Service	Potable, 68°F		Potable, 68°F		Potable, 68°F	
5	Line No.	Main Potable Line		Main Discharge Line		Hi-μ Amendment Line	
6	P&ID No./Section						
SERVICE CONDITIONS							
7	Fluid	Potable Water		Potable Water		Potable Water	
8	Normal Flow (units)	20-50 gpm		20-50 gpm		5-10 gpm	
9	Flow (units) Max. Min.	55 gpm	15 gpm	55 gpm	15 gpm	0 gpm	15 gpm
10	Temperature (units) Max. Min.	80° F	33° F	80° F	33° F	80° F	33° F
11	Pressure (units) Max. Min.	100 psig	0 psig	100 psig	0 psig	100 psig	0 psig
12	Velocity (units) Max. Min.						
13	Conductivity (units) Norm. Min.						
14	Specific Gravity Max. Norm.						
15	% Solids Max. Norm.			9%	6%		
16	Extra Conditions or Requirements						
MEASURING ELEMENT (Tag No.)							
17	Tube Size (units) Matl. Sched.	1 1/2"	Tefzel	1 1/2"	Tefzel	1 1/2"	ANSI 150 #
18	Liner Material	Tefzel		Tefzel		316L Stainless	
19	End Connections Type/Material	1 1/2"	ANSI 150 #	1 1/2"	ANSI 150 #	1 1/2"	ANSI 150 #
20	Electrode Material	Hasteloy C-276		Hasteloy C-276		Coriolis Type	
21	Meter Casing					304L Stainless	
22	Power Requirements/Electrical Code	120VAC		120VAC			
23	Enclosure Case					304L Stainless	
24	Grounding Type/Material						
25	Ultrasonic Cleaning						
26	Extra Features or Requirements						
TRANSMITTER (Tag No.)							
27	Output Signal (units)	4-20 mA		4-20 mA		1mA, RS485	
28	Calibrated Flow Range (units)	20-50 gpm		20-50 gpm		1-10 gpm	
29	Conduit Conn. Size (units)	3/4" NPT		3/4" NPT		1/2" NPT	
30	Mounting	Integral		Integral		Integral	
31	Enclosure Class	None		None		I	
32	Signal Cable Length						
33	Power Requirements/Electrical Code	24VDC		24VDC		24VDC	
34	Integrator						
35	Zero Return						
36	Alarms					3 LEDS, Solid or Blinking	
37	Special Modification						
38	Extra Features or Requirements						
Notes:							
 INTREPID Engineering Services, Inc.		FLOWMETERS		SHEET		JOB NUMBER	
				Attachment A			
				DOCUMENT NUMBER		REV	
				13400			

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[illegible]

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REQUESTED NO.				VENDOR: DWYER			
1	Tag No.			PS1			
2	Item No.			PS1			
3	Model No.			DA-31-153-4			
4	Service			Potable Water			
5	P&ID No./Section						
6	Type						
7	Range			1-35 psi			
SERVICE CONDITIONS							
8	Fluid			Potable Water			
9	Pressure Maximum	Normal (psig)		35	20		
10	Temperature Maximum	Normal (F°)		75°F	68°F		
11							
PRESSURE ELEMENT							
12	Type			Bourdon Tube			
13	Material			Mercury Switch			
14	Connection Size	Location		1/4" NPT	Local		
15	Case Blowout Disk						
16							
SWITCH							
17	Switch Quantity	Form					
18	Enclosure			Brass			
19	Conduit Connection and Size			1/2 "			
20	Rating	Volts	H _z or DC	120 VAC			
21	Rating	Amps	Watts	4A			
22	Minimum Differential	Trip Point		1.75 psi	Adjustable		
23	Differential	Fixed	Adjustable		Adjustable		
24	Adjustment	Internal	External		External		
25	Contacts	Open or Close	On Process	Increase or Decrease			
26	Actuates			Pump P-101			
27							
Notes:							
 INTREPID Engineering Services, Inc.				PRESSURE SWITCHES		SHEET	
						Attachment C	
						JOB NUMBER	
				DOCUMENT NUMBER		REV	
				13400			

END OF SECTION 13400

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SECTION 15025--WELDING

PART 1--GENERAL

WORK DESCRIPTION:

The Subcontractor shall furnish all labor, materials, equipment, and services necessary to perform all structural and pressure piping welding required in accordance with the Subcontract drawings and the following specifications.

Design, testing, inspection, filler materials, and workmanship requirements shall conform to the appropriate code.

WORK INCLUDED: Work includes, but is not limited to:

Structural welding
Pipe support welding
Pipe welding.

RELATED SECTIONS:

Section 05100 – “Structural Steel and Miscellaneous Metals”
Section 15404 – “Piping and Plumbing.”

QUALITY CONTROL:

Codes and Standards: Comply with requirements of the current revision of the following codes and standards, as specified in this specification:

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC (ASD) “Specification for Structural Steel Buildings - Allowable Stress Design (ASD) and Plastic Design”

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1 “Safety in Welding and Cutting”

AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT SNT-TC-1A “Personnel Qualifications and Certification in Nondestructive Testing”

AMERICAN WELDING SOCIETY (AWS)

AWS A2.4 “Symbols for Welding and Nondestructive Testing”
AWS A3.0 “Welding Terms and Definitions”
AWS D1.1 “Structural Welding Code-Steel”

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AWS QCI "AWS Standard for Qualification and Certification of Welding Inspectors"

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

Boiler and Pressure Vessel Code (BPV)

Section II "Material Specifications," Part C

Section V "Nondestructive Examination"

Section IX "Welding and Brazing Qualifications"

ASME B31.3 "Chemical Plant and Petroleum Refinery Piping"

IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY (INEEL)

INEEL Welding Manual

Weld Procedure Qualification:

Off-Site Procedures: Except for structural welding procedures prequalified per AWS D1.1, the Subcontractor shall establish and qualify Weld Procedure Specifications (WPSs) for any off-Site welding performed during this subcontract. Qualification of piping welding procedures shall be in accordance with the requirements of ASME BPV Code, Section IX. Approval will not relieve the Subcontractor of the sole responsibility for preparing procedures in accordance with the above referenced specifications.

The Subcontractor may use welding procedures from the *INEEL Welding Manual* listed in PART 3 Welding Processes paragraph for off-Site welding if a letter is submitted as vendor data stating that these procedures are being adopted for use in performance of this subcontract.

On-Site Procedures: Welding procedures from the *INEEL Welding Manual* listed in PART 3 Welding Processes paragraph shall be used for on-Site structural and pipe welding.

Welder Qualification:

Off-Site: Off-Site welding shall be performed by welders or operators qualified in accordance with AWS D1.1 for structural and pipe support welding and ASME BPV Code, Section IX for pipe and pipe attachment welding. Welders or welding operators qualified to *INEEL Welding Manual* procedures can be used for off-Site welding if the applicable INEEL weld procedures are identified and submitted as vendor data. When using *INEEL Welding Manual* procedures for off-Site welding, welders shall be qualified at the INEEL Welder Test Facility.

On-Site: All on-Site welding performed under this specification shall be performed by welders or welding operators qualified at the INEEL Welder Test Facility using the applicable procedures specified from the *INEEL Welding Manual*.

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Certification: Upon successful completion of the qualification test, the welder shall be provided with a certificate card by the Subcontractor (off-Site) or in compliance with the *INEEL Welding Manual* (on-Site). The certificate shall state the welding process, codes, and procedures under which the welder is qualified, and the name of the individual who issued the certificate. The welder shall carry the certificate card when performing welding under this contract. The Subcontractor shall have on file documentation, affidavits, and records of testing and test results that qualified the welder for certification. These records shall be certified by the Subcontractor and shall be submitted to the Contractor as vendor data.

Welder's Identification: The Subcontractor shall assign each welder an identifying number, letter, or symbol that shall be used by the welder to identify all piping or pipe attachment welds made by him/her.

Renewal of Qualification: Renewal of qualifications for a welder or welding operator working on-Site shall be in accordance with the *INEEL Welding Manual*. Renewal of qualifications of a welder or welding operator working off-Site shall be as required in ASME BPV Code, Section IX.

Nondestructive Examination Procedures: The Subcontractor shall establish detailed inspection procedures and acceptance criteria for each nondestructive examination required in accordance with the requirements specified in PART 3 EXECUTION - QUALITY CONTROL AND TESTING and additionally as required to ensure conformance of the work to the contractual requirements.

SUBMITTALS:

Unless otherwise noted, all submittals shall be made prior to construction start.

Submittals for Review:

1. Handling, storage, and control procedures for filler materials and backing material.
2. Cleaning procedures for stainless steel (if stainless steel is used).
3. Welding procedures and procedure qualification reports performed in accordance with ASME BPV Code, Section IX for off-Site welding including a list of procedures selected for use from the *INEEL Welding Manual*.
4. Subcontractor's nondestructive examination procedures.
5. Subcontractor's identification and control procedures for tools and equipment.
6. Detailed weld repair procedures.
7. Purge dam control procedure that shall include the prohibition of dissolvable purge dam material for pneumatically flushed piping systems and include methods to ensure removal of all purge dams.
8. Shop drawings for building structural welding shall show all welds, size, preparation, etc. The drawings shall differentiate between shop and field welds.

Submittals for Information:

1. Welding personnel qualification records
2. Subcontractor's nondestructive examination personnel qualification records
3. Certificates of conformance for weld filler materials.

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Submittals for Project Closeout:

1. Weld repair reports including weld identification, welder identification number, test procedure, reason for rejection, number of repairs required, and documentation that weld is repaired and accepted.
2. An isometric pipe weld map that shall include the following information: weld procedure specification, nondestructive examination (NDE) requirements, and unique identification number including welder's identification and completion date.
3. Weld inspection reports.

DEFINITIONS AND SYMBOLS:

Definitions for welding terms shall be in accordance with AWS A3.0 and ASME Section IX, as applicable. Weld symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

SAFETY:

As a minimum, safety precautions during welding shall conform to ANSI Z49.1 as well as any additional requirements specified in the subcontract documents.

DELIVERY, STORAGE, AND HANDLING:

Except as otherwise specified, filler materials and fluxes shall be stored and handled in accordance with the manufacturer's recommendations and approved procedures (off-Site) or the *INEEL Welding Manual*, Volume 2 (on-Site).

PART 2--PRODUCTS

GENERAL:

Welding equipment, electrodes, filler material, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator utilizing qualified welding procedures.

MATERIALS:

Filler Material: All filler material used in fabrication shall comply with the applicable requirements of ASME BPV Code, Section II, Part C, or the equivalent AWS filler material specification and shall have a certificate of conformance.

Magnetic Particle: All magnetic particle examination materials and equipment shall meet the requirements of ASME Section V, Article 25, SE-709, Paragraphs 5 and 6.

PART 3--EXECUTION

WELDING OPERATIONS:

Both off-Site and on-Site welding shall be accomplished in accordance with the qualified and approved welding procedures using qualified welders and/or welding operators. The use of such procedures will not

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relieve the Subcontractor of his responsibility for producing weldments conforming to the specified workmanship requirements. Welding shall not be done when the prevailing working or weather conditions could impair the quality of the completed weld.

Welding Processes:

Off-Site: Subject to approval of the Subcontractor's welding procedures.

Other welding processes may be used subject to specific approval. The Subcontractor shall submit pertinent data and proposed application of said other welding processes for evaluation by the Contractor prior to performing weld procedure qualification.

On-Site and Offsite Using INEEL Welding Manual:

Carbon Steel Tubular Sections, Plate and Structural Shapes: Welding shall be done in accordance with the *INEEL Welding Manual* and the applicable INEEL Welding Procedures C-3.5, C-6.9, or C-6.10.

Carbon Steel Pipe Welding Procedures: All welding shall be in accordance with ANSI B31.3 and the INEEL Welding Procedures C-3.0, C-8.0, and C-6.8

Tools and Equipment: Tools and equipment used in the fabrication of stainless steel and nickel-based alloys shall be free from corrosion and shall be maintained free of grease, carbon steel particles, or any other foreign matter detrimental to fabrication. Mechanical cleaning tools used for stainless steel shall not cause carbon steel to be embedded into the surface. Wire brush material shall be of a material compatible with the parent material. Grinding wheels shall be resin bonded. Metal removal tools, wire brushes, and grinding wheels shall not have been previously used for other than the parent material. The Subcontractor shall establish and maintain identification and control procedures for equipment and tools, including wire brushes and grinding wheels.

Joint Preparation and Fit-Up: Joint preparation including end preparation and alignment shall conform to the requirements of the applicable ASME code or the *INEEL Welding Manual* and to the following minimum requirements. Surfaces within 4 in. of any weld location shall be free of any oil, grease, paint, or other material that would prevent proper welding or produce objectionable fumes while welding. There shall be no free iron on the weld bead or heat-affected area of any stainless steel weld or on any surface where mechanical cleaning abrasion or other working of the metal surface has occurred. If the joints of carbon steel are prepared by arc cutting, the surface shall be ground to bright metal by mechanical means before welding. Plasma arc or laser beam cutting of austenitic stainless steel is permitted, provided the cut surface is machined or ground a minimum of 1/16 in. to bright metal.

Piping prepared for use with socket weld fittings shall have ends ground smooth, square and flat, with no perceptible burrs or irregularities. When performing automatic pipe welding, the pipe end preparation shall be made with tooling making the proper 90-degree end cut and the proper counter bore.

Pipe shall be cut accurately to measurements shown on the drawings and/or to suit field conditions. It is the Subcontractor's responsibility to field verify dimensions indicated on drawings prior to fabrication. A template shall be used in laying out headers, laterals, and other irregular details to ensure accurate cutting and a proper fit-up.

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Cleaning Stainless Steel: The weld joint and surrounding metal for at least 2 in. back from the joint preparation shall be cleaned before welding. Cleaning shall be accomplished by brushing with a clean stainless-steel brush and by scrubbing with a clean lint-free cloth that is moistened with an approved low (less than 35 ppm) chloride or chloride-free solvent. When the weld has cooled, remove all visible weld spatter, arc-strikes, flux, and scale; however, the base material thickness shall not be compromised. Stainless steels shall not be de-scaled with nitric-hydrofluoric acid solutions. Final cleaning shall be performed after inspection and when destructive testing is complete.

Preheat and Interpass Temperature Requirement: Preheat and interpass temperature shall be in accordance with the welding procedure specification.

Welding Requirements:

General: Welds shall be designed to provide complete fusion with the base metal. Pressure retaining groove welds shall be complete joint-penetration welds, unless otherwise specified. Weld beads shall be contoured to provide complete fusion at the sides of the bevel and to prevent slag entrapment. Flux, weld spatter, and slag shall be removed from each weld bead prior to depositing the succeeding pass. Arc strikes outside the area of permanent welds shall be avoided on base metal. Welds shall be finished as required for the applicable nondestructive examination method. Accessible welds on the inside surface of vessels prior to final closure shall be ground smooth and free of pits, crevices, and sharp projections. Peening shall not be allowed.

Consumable Inserts: The use of consumable inserts shall only be permitted with prior approval of the Contractor.

Structural Attachments: Permanent structural attachments shall not be welded to pressure-retaining parts unless such attachment is specifically specified, indicated, or approved by the Design Engineer. Such welds shall be inspected by the liquid penetrant method or magnetic particle method, as specified. Welding shall not be performed after final stress relief and/or hydrostatic testing.

Tack Welds and Temporary Welds: Qualified procedures and welders shall be used to make tack welds and to weld temporary attachments. Tack welds shall be inspected visually for defects and, if found to be defective, shall be removed. Areas from which temporary attachments have been removed shall be dressed smooth and inspected visually for conformance with the minimum thickness requirements of the parent metal and shall be examined by the liquid penetrant method or magnetic particle method, as specified. Welds found to be defective shall be repaired by a qualified welder and re-examined.

Post-Weld Heat Treatment: Post-weld heat treatment shall be as indicated and in conformance with the applicable ASME code requirements or WPS.

Welding Sequence: Welds that are located under nozzle necks, external reinforcement, or other obstructions shall be inspected and nondestructively examined prior to attachment of the obstruction. Welded joints connecting new piping or equipment to existing piping or equipment shall be made only after new piping or equipment has been successfully tested and cleaned.

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Identification of Welds: The welder shall permanently affix his assigned identification mark and applicable weld identification number adjacent to the weld using a vibro-etch tool. The welder also shall record this information on the weld map.

QUALITY CONTROL AND TESTING:

Qualified inspection, examination, and testing personnel shall perform inspections, examinations, and tests for welds and weldments in accordance with the approved procedures. All welds are subject to inspection by the Contractor's Representative who reserves the right to accept, reject, or demand removal of welds that are in violation of this specification or the applicable welding procedure specification. The Subcontractor shall provide access for this activity.

The Subcontractor shall coordinate the performance of NDEs with the fabrication and installation of the piping systems, so as to minimize interferences in the performance of both scopes of work and other unrelated work.

Weld Testing and Inspections:

Piping Welding Examination Required: The Contractor will provide all visual and magnetic particle examination and inspection. Examination and inspection of pipe welds shall be in accordance with ASME B31.3 (normal service conditions) Paragraph 341.4.1(a). In-process examination in accordance with Paragraph 341.4.1(b) shall be substituted for all radiographic examination. 100% of welds shall be magnetic particle examined. All piping welds shall be visually inspected prior to LP or MP examination. Visual acceptance criteria shall be in accordance with ANSI B31.3, Table 341.3.2A, "Normal Service." Acceptance standards for magnetic particle examination shall be in accordance with the following. Welds shall be free of cracks. All relevant indications greater than 1/16 in. shall be repaired. Pipe hanger welding shall be visually examined.

Structural Welding Examination Required: All welds shall be visually examined. The Contractor's Representatives may be used for off-Site shop visual examinations if the Subcontractor pays for this service.

FIELD QUALITY CONTROL:

The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

END OF SECTION 15025

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SECTION 15404--PIPING AND PLUMBING

PART 1--GENERAL

WORK DESCRIPTION:

The Subcontractor shall furnish and install all equipment, materials, and supplies and perform all work and operations necessary to install the piping systems and appurtenances and to complete the work as shown on the subcontract drawings and specified herein. Upon completing installation of the piping systems, the Subcontractor shall test as specified herein to verify that the systems are properly installed as required.

The Subcontractor shall field verify all piping dimensions prior to fabrication and shall maximize shop fabrication of spool pieces to minimize field work time.

Where instruments, valves, equipment, or controls are specified, the descriptive narrative shall govern over the catalog part number or model number.

WORK INCLUDED: Work includes, but is not limited to:

Furnish and install all valves, valve tags, tubing, instruments, gauges, mounting brackets, pipe, flanges, fittings, couplings, strainers, hangers, supports, insulation, and appurtenances as required to complete the work as shown on the subcontract drawings for the piping and instrumentation within the ISB Injection System and yard piping including tie-ins to existing pipe lines, insulation, and sleeper supports. Work includes all pipe welding and pipe support welding. Yard piping also includes well "down hole" piping, etc., unless noted "by others" as shown on the drawings. Work includes all cleaning, testing, and flushing of the piping systems, as specified herein.

RELATED SECTIONS:

Section 09900 – "Painting"
Section 15025 – "Welding"
Section 15405 – "Underground/Potable Water Supply"

QUALITY CONTROL:

Codes and Standards: Comply with requirements of the current revision of the following codes and standards, as specified in this specification:

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
ASME B31.3 "CHEMICAL PLANT AND PETROLEUM REFINERY PIPING"

Qualifications: Piping and plumbing shall be furnished and installed by a firm/company qualified, accredited, and regularly engaged in this type of work and shall maintain shop and facilities for fabrication and maintenance of subject equipment.

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Items of Any One Classification: Items that are used in quantity—such as valves, specialties, accessories, fittings, etc.—shall in each case be the product of one manufacturer and shall be used only for the services recommended by the manufacturer.

Materials, Products, and Equipment: Materials, products, and equipment shall be first quality and be furnished and installed in strict accordance with the subcontract drawings and these specifications.

Certificates of Compliance: Certificates of compliance shall be submitted for any material used in pressure-containing piping components and shall state that the material conforms to the specification listed under "Piping Materials." Unlisted materials may be used, provided Contractor approval is obtained prior to fabrication. Certificates of compliance for all weld filler materials shall be submitted as vendor data. Materials of unknown specification shall not be used for pressure-containing piping components.

Welding and Weld Examination: Welding and examination of all double wall and other pressure piping and pipe supports shall be performed in accordance with Section 15025.

SUBMITTALS:

Submittals for Review:

1. Catalog cuts and product data for all valves, pumps, instruments, tanks, specialty items, etc. are required to be submitted and approved by the Contractor before purchase
2. The Contractor must approve product data for pipe insulation, insulation jacketing, and installation instructions before purchase
3. Pressure test procedures and pipe flushing procedures prior to construction start
4. Sterilization procedure for potable water piping prior to construction start.

Submittals for Information:

1. Certificates of Compliance for all pressure-retaining components must be submitted for information before use.

Submittals for Project Closeout:

1. All hydrostatic test reports.

PART 2---PRODUCTS

GENERAL:

All materials, products, and equipment shall be as manufactured by the manufacturer specified in this section or an approved equal. All materials furnished shall be permanently marked or tagged to show ASTM designation and type of material. Materials shall not be steel stamped for identification. The finished materials shall be packaged for shipment; pipe ends shall be capped with plastic caps to protect the material from dirt and contamination during shipment and subsequent storage.

Unless otherwise specified, all pipes shall be sized according to the drawings. All valves, unless otherwise specified, shall be sized for the line into which they will be installed.

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Piping Materials:

Line Class	Service	Design Press	Max. Temp.	Pipe Material	Valve Body	Vessel/Tank Material	Notes
NJ	Potable water	150 psig	100°F	HDPE, Galv., CS	Bronze	N/A	2
NN	Process water (Inside and outside buildings)	150 psig	100°F	Carbon steel (Threaded for <2 in., BW for ≥2 in.)	Carbon steel (Screwed or flanged)	N/A	

NOTES:

1. Some potable water components inside building may be copper or bronze.
2. Some components inside building may be polyvinyl chloride (PVC), brass, or polypropylene.

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PIPING MATERIAL SPECIFICATION

Galvanized Carbon Steel
125–150 psi Service Rating
Line Class: NJ

Pipe Size	Description	Code
<u>Pipe</u>	Carbon steel, galvanized, Sch. 40, threaded and coupled ends.	ASTM A53
<2 in.		
2 in. and larger	Same as above except beveled ends.	ASTM A53
<u>Fittings</u>	150# Class, galvanized malleable iron screwed.	ASTM A197
<u>Flanges</u>		
<2 in.	Carbon steel, galvanized, 150# FF, threaded ends.	ASTM A105
2 in. and larger	Same as above except beveled ends.	ANSI B16.5
<u>Gaskets</u>	GrafoilR flange gasket, full face, 1/8 in. thick.	ANSI B16.21
<u>Bolting</u>	Hex head machine bolt with hex nut.	ASTM A307
		Grade B
<u>Branch Fittings</u>	Reducing tee.	
<u>Tubing</u>	Seamless copper tubing, soft annealed.	ASTM B75
<u>Tubing Fittings</u>	Brass Swagelok compression fittings, Crawford Co.	
<u>Gate Valves</u>	125# Class, bronze, SCRD, rising stem, bronze trim.	ASTM B62
<u>Globe Valves</u>	125# Class, bronze, SCRD, rising stem, bronze disc and seats, with backseat.	ASTM B62
<u>Check Valves</u>	Swing check, 125# Class, bronze, body, discs and seats. Screwed cap.	ASTM B62
<u>Ball Valves</u>	300# Class WOG, SCRD, bronze body, TFE seats and seals, lever operated.	ASTM B62

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PIPING MATERIAL SPECIFICATION

Carbon Steel
150 psi Service Rating
Line Class: NN

Pipe Size	Description	Code
<u>Pipe</u>		
<2 in.	Carbon steel, Sch 40, threaded ends.	ASTM A53,
2 in. and larger	Same as above except beveled ends.	Grade B
<u>FITTINGS</u>		
	150# malleable iron, threaded.	ASTM A197
<u>Flanges</u>		
	150# flat face carbon steel, slip-on.	ASTM A105, ANSI B16.5
<u>Gaskets</u>		
	Grafoil ^R flange gasket, 1/8 in. thick.	ANSI B16.21
<u>Bolting</u>		
	Hex head machine bolt with hex nut.	ASTM A307, Grade B
<u>Tubing</u>		
	Seamless copper tubing, soft annealed.	ASTM B75
<u>Tubing Fittings</u>		
	Brass Swagelok compression fittings, Crawford Co.	
<u>Branch Fittings</u>		
<2-in. header	Reducing tee, 150# malleable iron, threaded ends.	ASTM A197
2 in. and larger	Same as above, except beveled ends.	ASTM A197
<u>Globe Valves</u>		
<2 in.	800# Class, forged carbon steel body, threaded ends.	ASTM A105
2 in. and larger	150# Class, carbon steel body, flanged ends.	ASTM A216 WCB
<u>Gate Valves</u>		
<2 in.	800# Class, forged carbon steel body, threaded ends.	ASTM A105
2 in. and larger	150# Class, carbon steel body, flanged ends.	ASTM A216 WCB
<u>Check Valves</u>		
<2 in.	800# Class, forged carbon steel body, threaded ends.	ASTM A105
2 in. and larger	150# Class, carbon steel body, swing check, flanged ends.	ASTM A216 WCB
<u>Ball Valves</u>		
<2 in.	150# Class, carbon steel body, threaded ends, full port.	ASTM A216 WCB
2 in. and larger	150# Class, carbon steel body, flanged ends, full port.	ASTM A216 WCB

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PART 3--EXECUTION

Pipe Assembly Examination: The Contractor's Representative shall perform pipe assembly examination in accordance with ASME B31.3, Paragraphs 341 (Metallic Piping) and A341 (Non-Metallic Piping) as required for piping in "Normal Fluid Service," including the following;

Random examination of the assembly of threaded, bolted, and other joints must be performed to satisfy the examiner's criteria that they conform to the applicable requirements. When pneumatic testing is to be performed, all threaded, bolted, and other mechanical joints shall be examined.

Random examination during erection of piping shall be performed, including checking of alignment, supports, and cold spring.

Examination of erected piping for evidence of defects that would require repair or replacement and for other evident deviations from the intent of the design.

For nonmetallic pipe joints, not less than 5% of all bonded joints shall be examined by in-process examination. The joints to be examined will be selected to ensure that the work of each bonder and bonding operator making the production joints is examined.

Bonding Qualifications: The Subcontractor is responsible for the bonding of thermoplastic (PVC) piping done by the personnel in the Subcontractor's organization and shall conduct the required performance tests to qualify bonding procedure specifications and bonders or bonding operators in accordance with ASME B31.3, Paragraph A328. This involves subjecting a bonded test assembly to a hydrotest for the bonding procedure and for each bonder. The bonding procedure specification and performance qualifications for each bonder shall be submitted as vendor data for approval.

Soldering Procedure: Solders shall follow the procedure in the *INEEL Welding Manual* and in the *Copper Tube Handbook* of the Copper Development Association and ASME B31.3, Paragraph 333.4. This procedure shall be submitted as vendor data for information.

Insulation Installation: Insulation and jacket installation must be performed in compliance with the manufacturer's directions. Heat tracing must be installed prior to installation of insulation. Voids must be filled in with insulation pieces.

GENERAL INSTALLATION OF ALL SYSTEMS:

Shall conform to the applicable requirements of the ASME Code for Chemical Plant and Petroleum Refinery Piping (ANSI B31.3) and the Uniform Plumbing Code.

Accessibility: Items—such as valves, controls, access doors, specialties, and accessories—shall be installed so as to be readily accessible for operation, service, maintenance, and repair.

Pipelines: Pipelines shall be installed in a neat and orderly manner. Installation shall avoid interference with work of the other trades.

Subcontractor shall install unions or flanges in addition to those shown on the drawings to facilitate dismantling as may be required.

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Avoid tool marks and unnecessary pipe threads. Remove burrs formed when cutting pipe. Remove arc strikes, weld spatter, and slag from welded joints by chipping and wire brushing. Tools used on stainless-steel items shall be marked with blue paint and used on stainless-steel items only. Tools used on other materials shall not be used on stainless-steel items.

Joiners (length of pipe made by welding together or coupling together pieces shorter than 20 ft) will not be permitted unless approved by the Contractor's Representative. Where joiners are permitted, welds shall be made by welders and procedures qualified and certified in accordance with the requirements specified in the welding section.

Piping shall be cleaned of dirt, rust, scale, grease, and other foreign matter. Piping shall be kept clean as work progresses. Seal in accordance with underwriters requirements wherever piping passes through firewalls.

Pipe routings and pipe sizes shall be as indicated. Any proposed deviation from the indicated sizes and configurations shall be submitted to the Contractor's Representative for approval prior to implementation. Fabrication and installation tolerance shall be ± 1 in. maximum from the locations indicated.

Lines indicated with slopes shall be fabricated and installed to ensure that no pockets remain in the final installation. Cases where a problem is anticipated in sustaining the required slope shall be brought to the Contractor's Representative for resolution.

Indicating instruments shall be installed for easy reading from operating floors or platforms. If 6 ft or more above floors or platforms, set at a 45-degree angle.

Pipe and Tube Bends: A minimum bend radius of five pipe diameters may be used in place of elbows on stainless-steel pipe, carbon steel pipe, and copper tubing, provided room exists for the bend (not fitting to fitting). All bends shall be free from wrinkles, kinks, and thin or flat spots. "Out of Roundness" shall not exceed 6% between the minimum and maximum cross-sectional dimensions. All bends must be completed prior to beveling, flanging, or cutting to length.

PIPE JOINTS:

Threaded Pipe Joints: The threads of screwed joints of pipe, fittings, and couplings shall conform to the applicable requirements of ANSI B2.1. Threading shall provide the proper number of perfect threads to produce full metal-to-metal contact when assembled. Male threads shall be wrapped with Teflon tape or lubricated with an approved lubricant recommended for the service involved. The first two male threads shall not be wrapped.

Welded Pipe Joints: Welded joints shall be made as specified in Section 15025, "Welding."

Welding on Galvanized Pipe: Where it becomes necessary to do welding on galvanized pipe or components, the galvanizing shall be cleaned away a minimum distance of 3 in. from the welding point. After welding and weld examination are completed, the cleaned areas and ungalvanized components shall be coated with a hand-applied zinc-rich compound to the same thickness as the adjoining pipe.

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EQUIPMENT, INSTRUMENTS, ETC.:

Equipment shall be set in place, aligned, connected, and made ready for operation. Connections and required safety devices shall be installed. Initial lubrication shall be provided. Controls shall be set for efficient, stable operation.

Instruments and controls shall be installed and supported in a safe, rigid, neat, and orderly manner whether mounting is detailed or not detailed on the drawings. They shall be free from undue stresses and made suitable for normal use. Wall-mounted supports shall be of the type as recommended by the manufacturer of the instrument/control used and shall be provided and installed by the Subcontractor even if not indicated on the drawings.

All of the above shall be protected from damage during and after installation. At completion, work shall be free from tool marks, discolorations, cracks, scratches, chips, and other defects.

HANGERS, SUPPORTS, AND FASTENERS:

Piping shall be adequately supported during installation. Where permanent supports are not available at the time of piping erection, temporary supports shall be provided, as required. Piping shall not be temporarily supported from other piping or conduit.

Pipe hangers shall be fabricated and installed, as shown on the subcontract drawings. Where interferences occur with hanger placement, the Subcontractor shall submit an alternative position to the Contractor's Representative for approval.

Supports shall include wall brackets, riser clamps, hanger rods, pipe stands, pipe clamps, rollers, insulation protection saddles, pipe saddles, steel sections, shims, sleepers, and other suitable devices that may be required for the proper installation of piping.

PRIMER APPLICATION: Pipe supports and support components shall be prime coated after fabrication in accordance with Section 09900, "Painting."

FLASHING: The Subcontractor shall furnish and install flashing at all locations where piping penetrates walls. The flashing shall be "Dektite," as manufactured by ITW Buildex, Itasca, Illinois or equal, with the aluminum portion of the flashing painted to match the exterior wall color.

FLUSHING: All piping systems shall be cleaned by flushing after fabrication and inspection operations are completed and after the final tie-in welds have been made. A piping system specific flushing procedure detailing the process and equipment to be used shall be submitted and approved by the Contractor prior to flushing.

Liquid Lines. Liquid lines shall be flushed as follows:

Carbon steel, PVC, and copper lines shall be flushed with clean potable water.

Flushing velocity shall be high enough to entrain dirt and debris.

Duration of flushing shall be continuous until discharge water looks clean.

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To ensure the absence of moisture after flushing, the lines shall be blown dry with filtered compressed air.

General. The following requirements apply to both air and liquid lines:

Lines shall not be flushed into vessels or other equipment in which debris could settle.

Valves shall be in the open position, and check valves shall have the discs removed during the flushing operation.

Where practicable, in-line instruments shall be removed from the lines and instrument lines shall be disconnected prior to flushing.

Where it is impractical to remove the in-line instrument, permission shall be obtained from the Contractor's Representative to leave the instrument in-line, but the removable internals shall be removed.

Piping specialty items shall be retained in-line during the flushing operation; however, for items such as filters, the internals shall be removed.

Verification of cleanliness shall be by visual examination of an in-line 12-mesh strainer on the line discharge. The strainer shall be installed after the flushing duration is completed. Additional flushes through the strainer shall be performed until visual examination reveals no debris collection on the strainer.

The Contractor's Representative shall witness the flushing.

TESTING:

Piping shall be pressure tested after installation in accordance with ASME B 31.3, Paragraph 345 using approved testing procedures. Testing procedures including a sketch/print indicating valve lineup and test boundaries shall be submitted and approved by the Contractor prior to use. Piping material shall be cleaned externally and cleaned and flushed internally prior to testing. The Contractor's Representative will witness the tests. Joints, including welds, shall be exposed during initial testing of the piping installation. Upon completion of testing, piping shall be blown dry by using filtered compressed air. Openings shall be covered, capped, or plugged to prevent ingress of foreign matter. Testing shall include the following:

- (a) Instrument lines shall be disconnected prior to testing to prevent damage to instruments. Line-mounted instruments shall be removed from the line.
- (b) Equipment and other items not designed for the full test pressure shall be isolated from the test or removed from the line.
- (c) Piping shall be hydrostatically tested at the pressure, as indicated in Table 1.
- (d) Potable water, or other approved source, shall be used for hydrotesting of piping.

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- (e) The test pressure shall be continuously maintained for a minimum of 10 minutes and at the required examination pressure for such additional time as may be necessary to conduct the examination of joints for leakage.
- (f) Gauges listed in the testing procedures for performing pressure testing shall be calibrated by the INEEL calibration facility within 30 days of use. Test pressure shall be not less than 10% nor more than 90% of the gauge range. Pressure gauges shall be accurate to within 2% of span.
- (g) Instruments and other items removed or disconnected prior to testing shall be reconnected or reinstalled and made ready for operation.
- (h) A pressure-relief device shall be provided in the testing apparatus, having a set pressure equal to the test pressure plus the lesser of 50 psi or 10% of the test pressure.
- (i) Records shall be made of each piping system during the testing, including:
- Date of test
 - Identification of piping system tested
 - Test fluid
 - Test pressure
 - Certification of results by examiner

These records shall be submitted to the Contractor after testing for information.

Table 1. Pressure testing requirements.

Line Class or Piping		Type of Test	Minimum Test Pressure
NJ	Potable water (inside building)	Hydrostatic	175 psig
	Injection water (inside building)	Hydrostatic	150 psig

Sterilization:

General: The potable water piping system and tie-in shall be sterilized with a clean water and chlorine solution. The Subcontractor shall make the necessary arrangements for disposal of the water when draining the system. All cleaning and sterilizing shall be done in the presence of the Contractor's Representative.

All pipe, valves and fittings—which cannot be sterilized in accordance with the procedure outlined above—shall be thoroughly scrubbed in a disinfecting solution containing 1,000 ppm (1 lb of HTH to 75 gal of water), allowed to stand for 30 minutes, and flushed with clean water before installation.

Procedure: Samples shall be taken at the farthest point (test point) in the system from the point of chlorine injection. The concentration at the test point shall measure a minimum of 50-ppm residual chlorine. Water containing the prescribed chlorine concentration shall remain in the system for a period of at least 8 hours.

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The system then shall be thoroughly drained, flushed, and refilled with clean water, as often as necessary, until the chlorine content of the water at the test point is decreased to 0.20 ppm residual or less.

The isolating block valves in the existing main shall be closed and the new system shall be drained, thoroughly flushed with water, and then drained again after chlorination is completed and accepted.

Sampling: Samples of water taken from the sterilized lines of the system shall be delivered by the Subcontractor to the Industrial Hygiene Section Building, CF-612, for analysis prior to use of the water system. Sterilized sample containers can be obtained at the CF-612 Environmental Hygiene Lab, phone 526-2510.

Sterilized sample containers shall not be opened prior to actual sampling time. Every precaution shall be taken to minimize the possibility of contaminating the sample containers.

Water samples shall be taken from the sample point farthest from the water source and as directed by the Contractor. The sample point shall be fully opened and water allowed to run to the waste for 2 to 3 minutes. The flow then shall be restricted to permit filling the sample containers without splashing.

All samples shall be accompanied with a complete and accurate identifying data sheet. The Subcontractor shall deliver the water samples to the Environmental Hygiene Laboratory within the same working shift.

If the sample analysis indicated contamination is present, or that the residual chlorine content is greater than 0.20 ppm, the Subcontractor will sterilize and/or re-flush the entire system and have samples tested as often as necessary, until the specified test results are obtained.

Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the drawings and specifications.

FIELD QUALITY CONTROL:

Surveillance will be performed by the Contractor's Inspector/Contractor's Representative to verify compliance of the work to the drawings and specifications and to ensure that the required examinations are being performed.

END OF SECTION 15404

Project Title: **ISB Injection System**
Section Title: **Underground Injection and Potable Water Piping**
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SECTION 15405—UNDERGROUND INJECTION AND POTABLE WATER PIPING

PART 1---GENERAL

WORK DESCRIPTION:

The Subcontractor shall furnish all labor, materials, equipment, and supplies and perform all work and operations necessary to install underground fire protection/potable water piping and valves going to the ISB building in accordance with the drawings and this specification. References in this specification to other specifications, codes, standards, or manuals shall be the latest edition, including any amendments and revisions in effect as of the date of this specification.

WORK INCLUDES: Work includes, but is not limited to:

Fabricate, install, and test underground injection pipe/potable water pipe, fittings, thrust blocks, rodded connections, valves, valve stand pipes, impingement posts, locator ribbon, and all necessary accessories and components to ensure a complete and operable system. Subcontractor shall be responsible for coordinating all existing and new work.

RELATED SECTIONS:

Section 02200 – “Earthwork”
Section 03300 – “Cast-in-Place Concrete”
Section 15404 – “Piping and Plumbing.”

QUALITY CONTROL:

Manufacturers: Firms regularly engaged in the manufacture of American Water Works Association (AWWA) C-901 certified high-density polyethylene (HDPE) accessories of types and sizes required and whose products have been in satisfactory use in similar service for not less than 5 years will satisfy Contractor requirements.

Installer: A firm with at least 3 years of successful installation experience on projects with underground water piping similar to that required for this project will satisfy Contractor requirements. The installing Subcontractor shall be licensed in the State of Idaho.

Factory Mutual Compliance: Comply with Factory Mutual "Approval Guide and Loss Control Data Sheet 3-10."

Material Compliance: Provide piping, fittings, and related components with a UL listing or Factory Mutual approval. All piping, fittings, and related components shall be certified by AWWA for use with potable water.

SUBMITTALS:

Submittals for Review:

Subcontractor shall furnish copies of product data for all materials to the Contractor for approval prior to purchase.

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Subcontractor shall submit a hydrostatic test procedure, chlorinization procedure, and a flushing procedure to the Contractor for approval prior to performing tests/procedures. These procedures shall detail the test connection/flush points, isolation points, and test/flush boundaries. The pressure test procedure shall include a sketch showing all components of the testing apparatus.

Submittals for Information:

Subcontractor shall provide test results for disinfection testing. Disinfection report shall include the following as a minimum and shall comply fully with U.S. Department of Energy (DOE) and INEEL standards.

Disinfection Report:

1. Type and form of disinfectant used
2. Date and time of disinfectant injection start and time of completion
3. Test locations
4. Initial and 24-hour disinfectant residuals, quantity in treated water, in ppm for each outlet tested
5. Date and time of flushing start and completion
6. Disinfectant residual after flushing in ppm for each outlet tested.

Bacteriological Report:

1. Date issued, project name, and testing laboratory name, address, and telephone number
2. Time and date of water sample collection
3. Name of person collecting samples
4. Test locations
5. Initial and 24-hour disinfectant residuals in ppm for each outlet tested
6. Coliform bacterial test results for each outlet tested
7. Certification that water conforms, or fails to conform, to State of Idaho bacterial standards.

Submittals for Project Closeout:

None.

PART 2---PRODUCTS

GENERAL:

All materials, products, and equipment shall be as manufactured by the manufacturer specified in this section or approved equal. All components shall be rated for a working pressure of 175 psi, whether stated or not.

Pipe:

Iron pipe size must be equivalent to SDR 11 HDPE for potable water lines. Iron pipe size must be equivalent to SDR 15.5 HDPE for injection water lines.

Materials used for the manufacture of HDPE pipe and fittings shall comply with all requirements ASTM D3350 and have a PPI-recommended designation of PE3408.

All pipe and fittings shall meet the testing requirements of the most current version of AWWA C-901 (1/2 in. through 3 in.). The manufacturer shall furnish test data upon request.

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The same manufacturer shall provide pipe and fittings to ensure compatibility. All fittings shall be pressure rated to match the system piping to which they are joined. At the point of fusion, the outside diameter and minimum wall thickness of the fitting shall meet the outside diameter and minimum wall thickness specifications of AWWA C-901 for the same size of pipe. All fabricated fittings shall be properly rated according to manufacturer's written recommendations and clearly labeled on the fitting as such. Manufacturer shall have a written specification for all standard fabricated fittings with established quality control criteria and tolerances. Molded fittings shall be made from PE3408 HDPE and have fusion compatibility with the pipe. Molded fittings shall be manufactured in conformance with either ASTM D2683 or ASTM D3261 and be so marked.

The print line of the pipe shall include such markings as are required by the current version of AWWA C-901 or C-906. The performance requirements of the pipe and fittings shall be as stated in AWWA Standard C-901 (1/2 in. through 3 in.). The manufacturer shall comply with National Sanitation Foundation (NSF) Standard 14 by certifying in writing to the Design Engineer and marking the pipe with the NSF logo in the print line. The manufacturer shall comply with AWWA Standard C-901 by certifying in writing to the Design Engineer and marking the pipe with the appropriate AWWA standard in the print line.

The HDPE pipe and fittings shall be PE-3408 EHMW as manufactured by PolyPipe, Gainesville, Texas, (800) 433-5632; Plexco Performance Pipe as manufactured by Chevron Chemical Company; Drisco Pipe as manufactured by Phillips; or approved equal.

CURB STOP:

Curb stop valve shall comply with AWWA Standard C800-89 and ASTM B-62. Curb stop shall be a cast bronze body 90-degree ball valve with a stop and waste feature to enable the downstream line to drain when the valve is closed—Ford B66-777SW or equal. Supply two each 9-ft-long shut off rods for curb stops.

CURB BOX:

Supply and install extended-type curb box with arch pattern base appropriately sized for the supplied curb stop. Curb box shall be supplied with raised "WATER" lettering cast into box lid and standard pentagon bolt—Ford EA2-55-50 or equal. Supply two each wrenches for pentagon bolt.

Potable Water Yard Hydrants: Potable water shall be a freeze-proof hydrant having a self-closing level handle, 3/4-in. NPT inlet, and 60-in. burial depth. Hydrant shall have a self-maintained reservoir below frost line and an anti-siphon vacuum breaker. The hydrant shall have a 3/4-in. brass hose nozzle and a 1-1/2-in. galvanized steel hydrant casing. Hydrant shall be similar to Woodford Model S2. Hydrant and fittings shall be AWWA approved for use in potable water systems. Fittings shall be NPT Schedule 40 galvanized steel. Compact gravel block supporting hydrant to 90% of maximum density at optimum moisture content.

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MATERIALS AND EQUIPMENT:

Water Piping and Materials:

HDPE: Pipe shall meet AWWA C901 and have recommended pipe size, Plexco, Driscopipe, or approved equal.

Fittings: Underground fittings shall be heat fusion welded HDPE.

Joint-Restraining Devices: Joint-restraining devices other than thrust blocks shall not be used unless shown on the drawings or approved for use by the contractor on a case-by-case basis.

Thrust Blocks: Thrust blocks and rodding shall be sized and installed in accordance with NFPA 24, 8-6. Size thrust blocks for silt conditions shall be in accordance with NFPA 24 A-8-6.2.1.

Underground Pipe Identification: New underground pipelines shall be identified by use of a plastic ribbon no less than 3 in. in width with a message printed on the ribbon that identifies the actual pipeline contents. The ribbon shall be wrapped around the pipeline at no less than 1 wrap per 3 ft of run. The plastic ribbon shall be color coded in conformance with the following:

<u>Categories of Pipeline Contents</u>	<u>Tape</u>	<u>Lettering</u>
Injection Water	Brown	White
Potable Water	Green	White

PART 3--EXECUTION

Pipelines shall be sized and installed as shown on the drawings.

Execution:

Buried pipe and fittings may be joined by thermal fusion, or electrofusion as described in AWWA C901 only, except as specifically noted in the drawings to connect to dissimilar pipe materials. Mechanical fittings used with polyethylene pipe shall be specifically designed for or tested and found acceptable for use with polyethylene pipe. All connections shall be made in accordance with AWWA standards for potable water service.

Provide 4 in. of compacted sand bedding below the flow line of the pipe and 6 in. of compacted sand bedding above the flow line. Where vertical pipe runs exist, surround pipe with compacted sand bedding for a 9-in. radius around the centerline of the pipe.

PIPE PENETRATIONS THROUGH CONCRETE:

Bulkhead penetrations, 6-in. diameter Schedule 40 galvanized steel pipe, shall be placed as shown in the drawings. De-burr and smooth all sharp edges. Center the HDPE pipe in the bulkhead fitting and surround with compacted sand backfill. Compact the sand around pipe using a wood or plastic hand-tamper.

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Minimum Earth Cover:

Pipelines shall have a minimum earth cover of 5 ft to the top of pipe.

Acceptance Tests:

Flushing of Piping: New underground mains and lead-in connections to system risers shall be flushed thoroughly immediately after tie-in to system. Reference NFPA 24, Section 9-1.

Test of Piping System: All new system piping shall be hydrostatically tested at no less than a 150-psi pressure for 2 hours. Permissible leakage shall be as defined in the same section. Subcontractor's test procedure shall be submitted and approved by the Contractor before use.

The Contractor's Representative shall witness testing and flushing.

Sterilization:

General: The water piping system and tie-in shall be sterilized with a clean water and chlorine solution. The Subcontractor shall make the necessary arrangements for disposal of the water when draining the system. All cleaning and sterilizing shall be done in the presence of the Contractor's Representative.

All pipe valves and fittings that cannot be sterilized in accordance with the procedure outlined above shall be thoroughly scrubbed in a disinfecting solution containing 1,000 ppm (1 lb of HTH to 75 gal of water), allowed to stand for 30 minutes, and flushed with clean water before installation.

Procedure: Samples shall be taken at the farthest point (test point) in the system from the point of chlorine injection. The concentration at the test point shall measure a minimum of 50 ppm residual chlorine. Water containing the prescribed chlorine concentration shall remain in the system for a period of at least 8 hours.

Then the system shall be thoroughly drained, flushed, and refilled with clean water, as often as necessary, until the chlorine content of the water at the test point is decreased to 0.20 ppm residual or less. No chlorine shall be allowed to enter the injection wells.

The isolating block valves in the existing main shall be closed and the new system shall be drained, thoroughly flushed with water, and then drained again after chlorination is completed and accepted.

Sampling: Samples of water taken from the sterilized lines of the system shall be delivered by the Subcontractor to the Industrial Hygiene Section Building CF-612 for analysis prior to water system use. Sterilized sample containers can be obtained at the CF-612 Environmental Hygiene Lab, phone (208) 526-2510.

Sterilized sample containers shall not be opened prior to actual sampling time. Every precaution shall be taken to minimize the possibility of contaminating the sample containers.

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- 1 Water samples shall be taken from the sample point farthest from the water source and as directed by the
- 2 Contractor. The sample point shall be fully opened and water allowed to run to the waste for 2 to
- 3 3 minutes. The flow then shall be restricted to permit filling the sample containers without splashing.
- 4
- 5 All samples shall be accompanied with a complete and accurate identifying data sheet. The Subcontractor
- 6 shall deliver the water samples to the Environmental Hygiene Laboratory within the same working shift.
- 7
- 8 If the sample analysis indicated contamination is present, or that the residual chlorine content is greater
- 9 than 0.20 ppm, the Subcontractor will sterilize and/or re-flush the entire system and have samples tested
- 10 as often as necessary, until the specified test results are obtained.
- 11
- 12 The Contractor's Representative will perform surveillance to verify compliance of the work to the
- 13 drawings and specifications.
- 14
- 15 END OF SECTION 15405

Project Title: **ISB Injection System**
Section Title: **Bulk Bag Unloader**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

SECTION 15508--BULK BAG UNLOADER

PART 1--GENERAL

SUMMARY:

As required by this specification, the Subcontractor shall furnish and install one bulk bag unloader, complete with frame, unloader, screw feeder, hoist, and controls. The bulk bag unloader shall be a fully incorporated unit, designed for hoisting bulk bags into place, transferring the powder to the screw feeder in an enclosed environment, and then feeding to the eductor system through a vibratory hopper and metering screw.

Section Includes: Work includes, but is not limited to:

As required by this specification, furnish and install one bulk bag unloader, complete with screw feeder and related equipment. Provide warranty and submittals, as specified below.

Related Sections:

Section 13400, "Instruments and Equipment"
Section 16000, "Electrical General Provisions"
Section 16120, "Cable, Wire, Connectors, and Miscellaneous Devices."

Performance Warranty:

Unloading and feeding performance for each bulk powder shall be guaranteed based on Vendor's actual results demonstrated during full-scale feeding of a lactose powder sample on a vendor mockup. Provide modeling calculations to ensure acceptable feed rates for lactose powder (approximately 44 lb/ft³ bulk density).

Equipment Warranty: As part of the proposal package, the Vendor shall supply a copy of the equipment warranty documenting formal warranty coverage for 1 year from date of shipment.

REFERENCES: All equipment provided and the installation of the system shall comply with the applicable sections of the following codes and standards:

ASME/ANSI B31.3	"Chemical Plant and Petroleum Refinery Piping"
ANSI C2	"National Electric Safety Code"
NFPA 70	"National Electric Code"
NEMA KS 1	"Enclosed Switches."

SUBMITTALS:

Submittals for Review:

Vendor Approval: Subcontractor shall submit and obtain Contractor approval of modeling calculations, proposed bulk bag unloader, model selected, equipment warranty, principal dimensions, and details of construction prior to purchase and submittal of other required vendor data. The Vendor's proposal

Project Title: **ISB Injection System**
Section Title: **Bulk Bag Unloader**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

package shall be approved prior to bulk bag unloader purchase. Acceptable Vendors are VibraScrew, Inc., Totowa, New Jersey, or other approved equal.

Provide bulk bag unloader design package prior to delivery that will include:

- Instrument diagram of bulk bag unloader system

- Vendor cut sheets for all equipment

- Shop drawings, which must include:

 - Principal dimensions and details of construction

 - Equipment layout drawing

 - Sizes and location of piping connections

 - Instrumentation and control wiring diagrams

 - Floor anchoring system, including grouted or cast-in anchors with adjustable nuts.

Operational testing procedure shall be submitted and approved prior to use.

Submittals for Information (before final acceptance):

- Installation instructions

- Operations and Maintenance Manual

- Recommended spare parts list

- Recommended repair/replacement intervals.

Submittals for Project Closeout:

- Operational testing results

QUALITY CONTROL:

Qualifications: Bulk bag unloader shall be furnished by a firm/company qualified, accredited, and regularly engaged in this type of work and shall maintain shop and facilities for fabrication and maintenance of subject equipment.

Items of Any One Classification: Items that are used in quantity—such as valves, specialties, accessories, fittings, etc.—shall in each case be the product of one manufacturer and shall be used only for the services recommended by the manufacturer.

PART 2---PRODUCTS

GENERAL:

The bulk bag unloader system shall be as manufactured by VibraScrew, Inc. (ref. Quote #ID-02-506 Rev. 1) or an approved equal.

MATERIALS:

Bulk Bag Unloader: Bulk bag unloader with standard feature including hoist and lift device, enclosed bulk bag unloader, metered screw feeder, and automatic low-level shutoff. The bulk bag unloader shall:

- Be mounted on a 4-in. steel tubular frame

Project Title: **ISB Injection System**
Section Title: **Bulk Bag Unloader**
Revision Number: 0

Project Number: N/A
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- Include a bag support hopper to seat and seal bag, which totally encloses bottom of bag to protect against spillage
- Include two-point dust collection including bag perimeter collection ring and bag outlet system, which terminate in 3-in. ports
- Include a 12 × 18-in. access door, gasketed with locking quick release clamps
- Have a 10-in. outlet with Neoprene sleeve and 304 stainless-steel clamps.

The metered screw feeder shall:

- Be equipped with 3-in. diameter stainless-steel feed screw and tube
- Include a ¾-hp DC drive
- Have an SCR motor control compatible with 115 V/1 ph/60 hz electricity with controller, NEMA 4 enclosure, 10 turn potentiometer, pilot light, fuses, and auto shut-off feature
- Be capable of a flowrate range of 7.0 to 53.0 ft³/hr lactose powder (bulk density approximately 44.0 lb/ft³).

Bulk Bag Unloader Accessories:

The following connection shall be provided as shown on the contract drawings:
3.5-in. OD nipple connection from screw feeder.

Electrical:

Electrical enclosures shall be NEMA Type 4. Provide liquid-tight flexible conduit for connections of motors and for other electrical equipment subject to vibration.

Floor Anchors:

Supply grouted or cast-in anchors with adjustable nuts under base plates to allow for level installation of bulk bag unloader.

PART 3---EXECUTION

GENERAL INSTALLATION OF ALL SYSTEMS:

Bulk bag unloader handling/installation shall follow procedures specified in the INEEL Hoisting and Rigging Manual. Equipment shall be set in place, aligned, connected, and made ready for operation.

Piping shall conform to the applicable requirements of ASME Code B31.3 and the codes referenced above.

Operational Testing: Assembled unit shall be fully tested at design powder flowrate to confirm proper hydraulic, electrical, and leak-free airborne performance of basic system and all accessories by the Subcontractor. Subcontractor shall submit test procedure for approval prior to use.

Project Title: **ISB Injection System**
Section Title: **Bulk Bag Unloader**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

Accessibility: Items such as valves, controls, cleanout ports, and accessories shall be installed so as to be readily accessible for operation, service, maintenance, and repair. Indicating instruments shall be installed for easy reading from operating floors or platforms. If 6 ft or more above floors or platforms, set at a 45-degree angle.

Electrical Installation:

All electrical components and installation shall be in accordance with Section 16000, "Electrical General Provisions."

Unloader shall be installed plumb and level.

EQUIPMENT, FIXTURES, ETC.:

Equipment shall be set in place, aligned, connected in accordance with the applicable drawing, and made ready for operation. Connections and required safety devices shall be installed. Initial lubrication shall be provided. Controls shall be set for efficient, stable operation.

Instrumentation support fixtures shall be installed and supported in accordance with the applicable drawings in a safe, rigid, neat, and orderly manner. They shall be free from undue stresses and made suitable for normal use. Wall-mounted supports (if required) shall be of the type as recommended by the manufacturer of the fixture used.

All of the above shall be protected from damage during and after installation. At completion, work shall be free from tool marks, cracks, scratches, chips, and other defects.

FIELD QUALITY CONTROL:

Contractor Inspections: The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

ATTACHMENTS:

None.

END OF SECTION 15508

Project Title: **ISB Injection System**
Section Title: **Eductor**
Revision Number: **0**

Project Number: N/A
Revision Date: 01/23/03

1 SECTION 15509--EDUCTOR

2
3 PART 1--GENERAL

4
5 WORK DESCRIPTION:

6
7 The Subcontractor shall furnish and install all equipment, materials, and supplies and perform all work
8 and operations necessary for furnishing and installing the eductor as shown on the subcontract drawings
9 and specified herein.

10
11 WORK INCLUDED: Work includes, but is not limited to:

12
13 Furnish and install the eductor complete with washdown hopper, hopper lid, dust filter, and piping as
14 shown of the contract drawings.

15
16 Warranty: The Vendor shall warrant that the eductor manufactured and supplied shall be free from defects
17 in material and workmanship for a period of 3 years from delivery date to the installation site. The
18 warranty shall be submitted as vendor data for approval prior to purchase.

19
20 Certification: The Vendor shall supply a written assessment of the integrity of the eductor that has been
21 reviewed and certified by an independent, Registered Professional Engineer in accordance with
22 40 CFR 264.192, "Ground-water Protection Standard."

23
24 QUALITY CONTROL:

25
26 Qualifications: The eductor shall be furnished and installed by a firm/company qualified, accredited, and
27 regularly engaged in this type of work and shall maintain shop and facilities for fabrication and
28 maintenance of subject equipment.

29 Materials, Products, and Equipment: Materials, products, and equipment shall be first quality and be
30 furnished and installed in strict accordance with the subcontract drawings and these specifications.

31
32 SUBMITTALS:

33
34 Submittals for Review:

35 Warranty shall be submitted to Contractor for review and approval prior to purchase.
36 Shop drawings and catalog data shall be submitted for review and approval prior to purchase and shall
37 include the following:

38
39 Principal dimensions and details of construction
40 Sizes and location of fittings and components
41 Data as necessary to accurately describe all equipment furnished.

42
43 Installation leak test procedure shall be submitted for approval before use.

44
45 Submittals for Information:

46 Education rate calculations performed in accordance with ASTM D1998 shall be submitted for
47 information.

Project Title: **ISB Injection System**
Section Title: **Eductor**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

Submittals for Project Closeout:

Certification by Registered Professional Engineer for review and approval prior to purchase
Installation leak test records in accordance with ASME B31.3, Paragraph 345.2.7, shall be submitted after the leak test.

PART 2---PRODUCTS

GENERAL:

The eductor shall be as manufactured by Elmridge Jet Apparatus or an approved equal.

MATERIALS:

Eductor (see Attachment A, Sheet 1): The eductor shall be a solids eductor that is able to educe up to 53 ft³/hr lactose powder (bulk density approximately 44 lb/ft³) into a 50-gpm water stream or up to 21.3 ft³/hr into a 20-gpm water stream and made of 316-L stainless-steel construction, machined from bar.

Eductor Appurtenances:

Suction (to washdown hopper) and discharge connections shall be 1.5-in. 150# ANSI RF flanges.
Motive liquid inlet shall be 1-in. 150# ANSI RF flange.

Washdown Hopper (see Attachment A, Sheets 2 and 3): The washdown hopper shall join with the 1.5-in. 150# ANSI RF flange of the eductor with a 1.5-in. 150# ANSI FF flange. The hopper shall be made of 316-L stainless-steel construction and include a 14-gauge 316-L stainless-steel lid.

Washdown Appurtenances:

Discharge connections (to eductor) shall be 1.5-in. 150# ANSI FF flanges.
Motive inlet shall be a 1-in. NPT male fitting.
Powder inlet shall be a 22.5-in. inlet, enclosed with a 14-gauge 316-L stainless-steel lid with two 3.5-in. OD nipples (see Attachment A, Sheet 2).

PART 3---EXECUTION

All of the above shall be protected from damage during shipment, installation, and after installation. At completion, work shall be free from tool marks, discolorations, cracks, discontinuities, and other defects.

QUALITY CONTROL TESTING:

Testing shall include, but not be limited to, the following:

Eductor, hopper, and appurtenances shall be leak tested in accordance with ASME B31.3, Paragraphs 345.2 through 345.7. The leak test shall be maintained for at least 10 minutes, and all joints and connections shall be examined for leaks. The Contractor's Representative shall witness this test.

Project Title: **ISB Injection System**
Section Title: **Eductor**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

1 FIELD QUALITY CONTROL:

2
3 The Contractor's Representative will perform surveillance to verify compliance of the work to the
4 drawings and specifications.

5
6 ATTACHMENTS:

7
8 ATTACHMENT A:

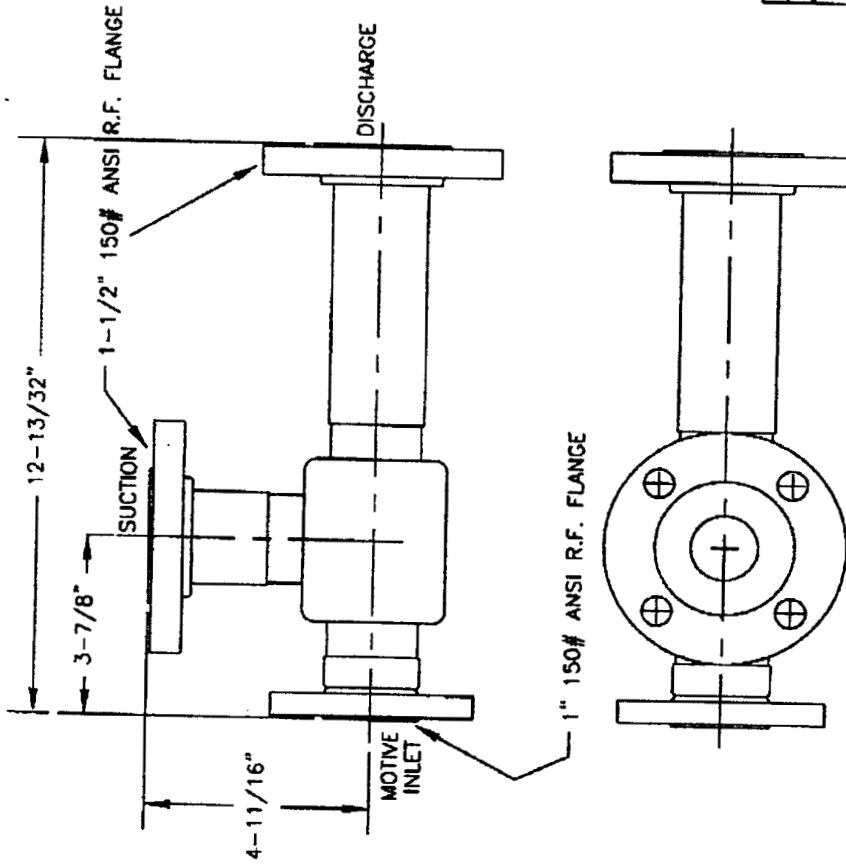
- 9
1. Eductor
2. Washdown hopper

10

Project Title: ISB Injection System
 Section Title: Eductor
 Revision Number: 0

Project Number: N/A
 Revision Date: 01/23/03

ALL BOLT HOLES STRADDLE CENTERLINE



FLANGE DIMENSIONS CONFORM TO ANSI/ASME B16.5 CLASS 150

DIMENSIONS FOR PN20 CLASS FLANGES AS PER ISO 7005-1 : 1992 (E)
 ARE DESIGNED TO BE INTERCHANGEABLE WITH FLANGES TO AMERICAN STANDARDS
 ANSI/ASME B16.5 AND MSS SP44

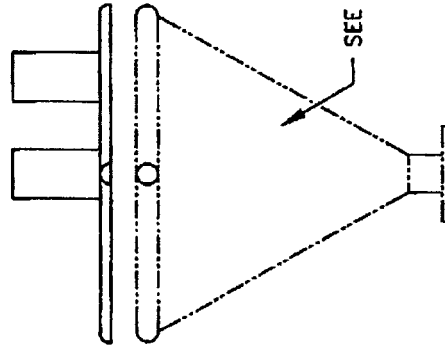
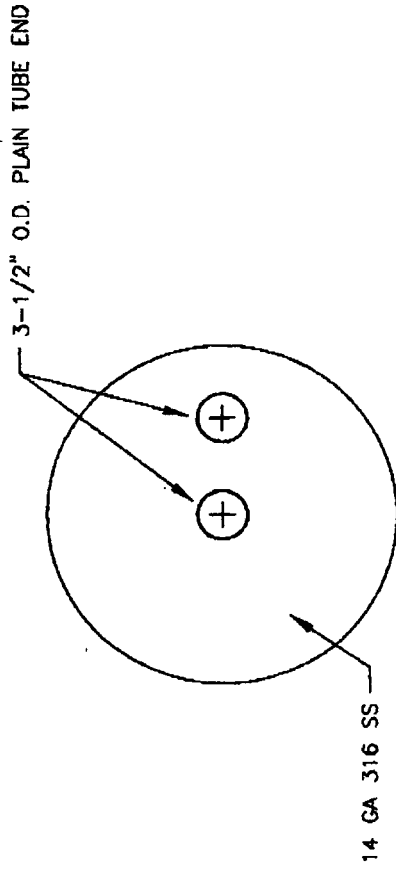
DIMENSIONS AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

PRELIMINARY
 DO NOT SCALE

NO.	DATE	REVISION	BY
ELMIRIDGE TORONTO, ONTARIO, CANADA LONDON, MICHIGAN, USA			
PROJECT: Liqui-Jet Solids Eductors			
PART: FBTLSS Dimensions			
MATERIAL: FBTLSS			
SCALE: NONE DRAWN BY: B.W. DATE: 11/6/95 APPROVED BY:			
NOTE: 15-FBTLSS-8-0 DRAWING NUMBER: 1789 REV. NO.: -A 1.0			

Project Title: ISB Injection System
 Section Title: Eductor
 Revision Number: 0

Project Number: N/A
 Revision Date: 01/23/03



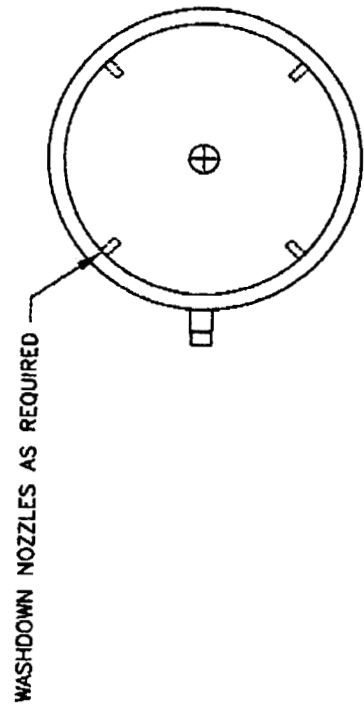
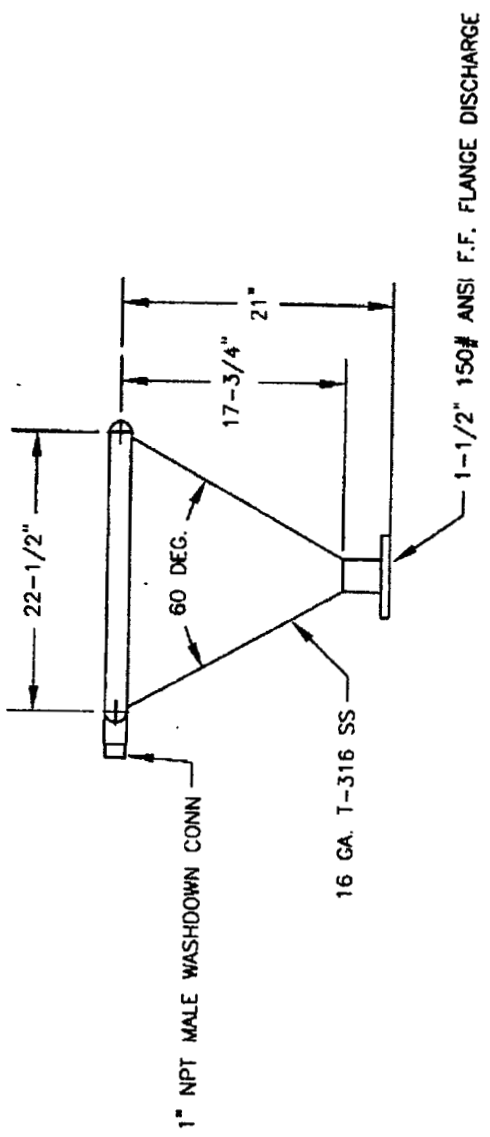
PRELIMINARY
 DO NOT SCALE

NO.	DATE	REVISION	BY
ELBRIDGE TORONTO, ONTARIO, CANADA JET APPARATUS LIVONIA, MICHIGAN, USA			
PROJECT: Liqui-Jet Solids Eductors			
PART: ES2044 Lid for 1-1/2 cu-ft Washdown Hopper			
MATERIAL: 1			
SCALE: NONE DRAWN BY: B.W. DATE: 5/7/02		RELEASE DATE: DATE: 5/7/02	
APPROVED BY: DATE:		DRAWING NUMBER: 3152 REV: -A I.O.	

DIMENSIONS AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

Project Title: ISB Injection System
Section Title: Educator
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03



MAT'L: ALL 316 SS

NO.	DATE	REVISION	BY
ELMIRIDGE TORONTO, ONTARIO CANADA LONDON, MICHIGAN USA			
PROJECT: Liqui-Jet Solids Educators			
PART: 1-1/2" Flange x 1-1/2 cu-ft Washdown Hopper			
MATERIAL: 16 GA. T-316 SS			
SCALE: None			
DRAWN BY: B.W.			
DATE: 10/02/98			
APPROVED BY:			
DATE:			
NOTE: F1.SWPH15-6-D			
DRAWING NUMBER 2178			
REV/A 1.0			

DIMENSIONS AND SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

1 2 END OF SECTION 15509

Project Title: **ISB Injection System**
Section Title: **HVAC/ Ductwork**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

SECTION 15802--HVAC/ DUCTWORK

PART 1--GENERAL

SUMMARY:

The Subcontractor shall furnish and install all equipment, materials, and supplies and perform all work and operations necessary to install the HVAC systems and appurtenances and to complete the work as shown on the subcontract drawings and specified herein. Upon completing installation of the HVAC systems, the Subcontractor shall test as specified herein to verify that the systems are properly installed and operate as required.

The Subcontractor shall field verify all ductwork dimensions, prior to fabrication and shall maximize shop fabrication of ductwork to minimize field work time.

Section Includes: Work includes, but is not limited to:

AIR UNIT HEATERS IN ISB INJECTION BUILDING

- Exhaust ventilators
- HVAC units in lab and office
- Lab exhaust ductwork
- Supports for ductwork, unit heaters, and exhaust ventilators, including additional cross members attaching to the roof purlins.

RELATED SECTIONS:

Section 09900 – “Painting”

SYSTEM DESCRIPTION:

The heating system consists of 4 unit heaters in the Nutrient Storage Area within the building and individual heating and air conditioning units in the lab and office. The building exhaust system consists of two roof-mounted powered exhaust ventilators. There is one exhaust ventilator in the lab with associated ductwork. Ductwork also is required for the fume hood exhaust.

SUBMITTALS:

Submittals for Review:

Catalog cuts of unit heaters and HVAC units shall be submitted for review and approval prior to purchase.
Catalog cuts of exhaust ventilator shall be submitted for review and approval prior to purchase.
Shop drawings showing principal dimensions, details of construction, and materials shall be submitted for review prior to purchase.

Submittals for Information:

Catalog cuts of all purchased ductwork items such as stationary louver, elbows, transitions, flow, and support items shall be submitted for information before final acceptance.

Submittals for Project Closeout:

None.

Project Title: **ISB Injection System**
Section Title: **HVAC/ Ductwork**
Revision Number: **0**

Project Number: **N/A**
Revision Date: **01/23/03**

QUALITY CONTROL:

The Subcontractor shall comply with the requirements of the current revision of the following codes and standards, as referenced and specified in this section.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC *Manual of Steel Construction*

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36 "Standard Specification for Carbon Structural Steel"
ASTM D1785 "Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe,
Schedules 40, 80, and 120"

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating
Systems"
NFPA 90B "Standard for the Installation of Warm Air Heating and Air-Conditioning
Systems"

**SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL
ASSOCIATION, INC. (SMACNA)**

SMACNA "HVAC Duct Construction Standards Metal and Flexible"
SMACNA "HVAC Systems Duct Design"
SMACNA "Rectangular Industrial Duct Construction Standards"
SMACNA "Round Industrial Duct Construction Standards"

UNDERWRITERS LABORATORIES (UL)

UL-181 "Factory-Made Air Ducts and Air Connectors"

PART 2---PRODUCTS

GENERAL:

All materials, products, and equipment shall be manufactured as specified on the contract drawings and in this section or approved equal. Products shall be in accordance with Duct Construction Standards (HVAC, Round, or Rectangular), SMACNA, and the Uniform Mechanical Code.

Ductwork size, location, and permissible fitting configurations are shown on the subcontract drawings. All fittings installed in the ductwork system shall have loss coefficients less than or equal to those shown in the SMACNA "HVAC Systems Duct Design" Loss Coefficient tables.

Project Title: **ISB Injection System**
Section Title: **HVAC/ Ductwork**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

System components shall be designed to operate at the given design parameters at an altitude of 5,000 ft.

DUCTWORK:

Material gage, duct reinforcing, and connections shall be in accordance with the SMACNA standard for the given pressure classification.

The Contractor's Representative shall approve duct system material substitutions. In the case of a substitution, the Subcontractor shall provide calculations proving that noise level, total pressure loss, system flow characteristics, and integrity for an "or equal" substitution are all equal to or better than the system as designed and specified.

Round Duct Materials: Round duct gauge shall be in accordance with Table 3-2B of HVAC Duct Construction Standards Metal and Flexible, SMACNA. Duct materials shall be G-60 coated galvanized steel of ASTM A653 ("Standard Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated [Galvannealed] by the Hot Dip Process") and A924 ("Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process") grades. Uncoated, polyvinyl-coated, aluminum-alloy coated, or aluminum-zinc alloy coated steel or stainless steel may be used if a minimum corresponding base metal thickness and material strength is provided as approved by the Contractor's Representative. Lock-forming quality is required. The use of an alternative material requires approval by the Contractor's Representative.

Duct Supports:

Ducts shall be supported in accordance with standard details of SMACNA "HVAC Duct Construction Standards Metal and Flexible". Structural steel shapes shall be in accordance with *Manual of Steel Construction*, AISC, ASTM A36, "Standard Specification for Carbon Structural Steel." Carbon steel supports shall be painted in accordance with Section 09900, "Painting."

DUCT SYSTEM EQUIPMENT:

Exhaust Ventilator: Exhaust ventilator shall be as specified in the "fan schedule" on the contract drawings and additionally shall be supplied with a bird screen. The Subcontractor shall design, furnish, and install additional roof-supporting members and flashing to mount the exhauster in the roof.

Unit Heaters: Unit heaters shall be as specified in the "unit heater schedule" on the contract drawings. The Subcontractor shall design, furnish, and install the unit heater mounting supports. Additional members may be added between the roof purlins for this purpose.

Heat Pump Units: Heat pump units shall be as specified in the "heat pump schedule" on the contract drawings. The Subcontractor shall install units in accordance with the manufacturer's instructions. The Subcontractor shall procure, design, furnish, and install the unit-mounting supports, as needed.

Ductwork Sealant: Duct sealant shall be nonhardening, nonmigrating mastic or liquid elastic sealant, as compounded and recommended by the manufacturer, specifically for sealing joints and seams in ductwork.

Project Title: **ISB Injection System**
Section Title: **HVAC/ Ductwork**
Revision Number: **0**

Project Number: N/A
Revision Date: 01/23/03

DUCTWORK INSULATION:

Ductwork insulation is not required.

PART 3---EXECUTION

FABRICATION AND INSTALLATION OF DUCTWORK:

Assemble and install ductwork in accordance with recognized industry practices, which will achieve air tight and noiseless systems capable of performing each indicated service. Install each run with a minimum of joints. Align ductwork accurately at connections. Coordinate duct installation with installation of accessories and other associated work of the ductwork system. Installation shall be in accordance with SMACNA Duct Construction Standards (HVAC, Round, or Rectangular) and the Uniform Mechanical Code.

Ductwork connections shall be in accordance with the applicable SMACNA Duct Construction Standard. Flanged connections shall be installed where shown on the contract drawings. Gasket material for flanged connections shall be 1/8-in. neoprene.

Duct Gauge, Supporting, and Reinforcing: Unless otherwise shown on the subcontract drawings, duct gauge, hanger spacing, and reinforcing shall be in accordance with SMACNA "HVAC Duct Construction Standards Metal and Flexible." Hangers shall be installed in accordance with the requirements of the appropriate SMACNA standard for the duct material gauge, reinforcing, pressure classification, and duct classification unless otherwise shown on the contract drawings.

Equipment Installation: Equipment installation shall be in accordance with SMACNA "HVAC Duct Construction Standards" and the manufacturer's recommendations. Holes for damper rods, thermostats, etc. shall be drilled or machine punched.

CLEANING AND PROTECTION:

Clean Ductwork Internally: Clean ductwork internally, unit-by-unit as it is installed. Clean the external surfaces of foreign substances that might cause corrosive deterioration of the metal. Or, where air distribution accessories and ductwork are to be painted, clean the surfaces of foreign substances that might interfere with painting or cause paint deterioration.

Temporary Closure: At ends of ducts that are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering, which will prevent the entrance of dust and debris until the time connections are to be completed.

FIELD QUALITY CONTROL:

Contractor Inspection: The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

END OF SECTION 15802

Project Title: **ISB Injection System**
Section Title: **Earthwork**
Revision Number: **0**

Project Number: **N/A**
Revision Date: **01/23/03**

SECTION 02200--EARTHWORK

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

Clearing and grubbing, as required

Excavating all materials encountered, of every description, for completion of the subcontract as shown on the drawings and as specified herein.

Backfilling all excavations for footings, foundations, pipe and utility trenches, etc.

Installing a locator ribbon above utilities installed under this subcontract

Compacting all backfill, as specified herein

Finish grading and grading for surface drainage.

REFERENCES:

The following documents, including others referenced therein, form part of this section to the extent designated herein.

AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (AASHTO)

	"Standard Specifications for Transportation Materials and Methods of Sampling and Testing"
AASHTO M145	"Recommended Practice for the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes"
AASHTO T11	"Standard Method of Test for Materials Finer Than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing"
AASHTO T27	"Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates"
AASHTO T99	"Standard Method of Test for the Moisture-Density Relations of Soils Using a 5.5 lb (2.6 kg) Rammer and a 12 in. (305 mm) Drop"
AASHTO T238	"Standard Method of Test for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)"

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1926.650	"Excavations"
-----------------	---------------

IDAHO TRANSPORTATION DEPARTMENT (ITD)

SSHC	"Standard Specification for Highway Construction"
------	---

Project Title: **ISB Injection System**
Section Title: **Earthwork**
Revision Number: 0

Project Number: N/A
Revision Date: 01/23/03

1 SUBMITTALS:

2
3 Submittals for Review:

4 No vendor data are required for this section unless an "or-equal" item is proposed. "Or-equal items are to
5 be submitted for approval prior to purchase.

6
7 Submittals for Information: None.

8
9 Submittals for Project Closeout: None.

10
11 DELIVERY, STORAGE, AND HANDLING:

12
13 If used, explosives shall be handled, stored, transported, and used within the safety limitations established
14 by the U.S. Department of Energy Idaho Operations Office (DOE-ID).

15
16 PART 2--PRODUCTS

17
18 MATERIALS:

19
20 Satisfactory Soil Materials: Satisfactory soil materials are defined as those complying with
21 AASHTO M145, soil classification Groups A-1, A-2-4, A-2-5, and A-3.

22
23 Unsatisfactory Soil Materials: Unsatisfactory soil materials are those defined in AASHTO M145 soil
24 classification Groups A-2-6, A-2-7, A-4, A-5, A-6, and A-7; also peat and other highly organic soils.

25
26 Backfill and Fill Material: "Satisfactory" soil materials are free of clay, rock, gravel larger than 3 in. in
27 any dimension, debris, waste, frozen materials, vegetable, and other deleterious matter. Select pit run
28 gravel is available at the Lincoln Boulevard or Test Area North (TAN) gravel pits. Gravel pit material and
29 use of the gravel pits shall be at no cost to the Subcontractor. Upon completion of operations involving
30 fill material removal, the Subcontractor shall grade and reshape the disturbed areas. Sloped surfaces shall
31 meet the requirements of 29 CFR 1926, "Safety and Health Regulations for Construction Excavations."

32
33 Base or Leveling Course Material: Naturally or artificially graded mixture of 3/4-in. maximum size
34 crushed gravel, crushed stone, natural and crushed sand. Material shall meet the requirements of ITD
35 Subsection 703.04.

36
37 Buried Pipe Identification Ribbon: See the appropriate piping or electrical specifications for Buried Pipe
38 Identification Ribbon requirements.

39
40 Locator Ribbon: Ribbon shall be 3 in. wide and shall be red for all electrical conduits, electrical cables,
41 and telephone cables. Green ribbon shall be used for all buried potable water lines. Brown ribbon shall be
42 used for all wastewater lines. Yellow ribbon shall be used for all other buried pipelines. Orange ribbon
43 shall be used on cathodic protection. For trenches containing multiple pipelines, separate ribbons shall be
44 supplied for each pipeline in the trench. Ribbon shall be tape manufactured by Reef Industries or Allen
45 Markline or equal and shall have metal foil that is completely encased in plastic so as to be unaffected by
46 cathodic protection systems and can be easily detected by metal detectors. The ribbon shall be printed
47 with the manufacturer's standard wording "CAUTION ELECTRIC LINE BURIED BELOW," for all
48 electrical conduits, phone lines, etc.; "CAUTION BURIED PIPELINE BELOW," for all buried pipelines;
49 and "CAUTION CATHODIC PROTECTION," for all buried cathodic protection systems.

Project Title: **ISB Injection System**
Section Title: **Earthwork**
Revision Number: **0**

Project Number: N/A
Revision Date: 01/23/03

PART 3--EXECUTION

EXCAVATION:

Clearing and Grubbing: All areas to be occupied by new buildings, roadways, storage tanks, berms, and other similar structures plus 10 ft outside these areas and 1 ft outside sidewalk areas and pipe trenches shall be stripped and cleared of all brush, weeds, rubbish, and organic matter. All vegetable matter, roots, brush, and debris encountered during the stripping operations shall be removed from the cleared areas to a depth of at least 4 in. below the subgrade. Resulting depressions shall be completely backfilled and compacted in accordance with the applicable part of these specifications, except in those cleared areas where further excavation is required. Stripped material shall be stockpiled or disposed of as specified hereinafter.

Earth Excavation: Earth excavation includes removal and disposal of pavements and other obstructions visible on ground surface, underground structures and utilities indicated to be demolished and removed, soil material of any classification, and other materials encountered that are not classified as rock excavation or unauthorized excavation.

Rock Excavation: Rock excavation consists of removal and disposal of materials encountered that cannot be excavated without drilling and blasting or requiring use of special equipment. If rock is encountered during excavation, work shall be stopped pending additional direction from the Contractor's Representative.

Unauthorized Excavation: Unauthorized excavation consists of removal of materials beyond indicated elevations or dimensions without specific direction by the Contractor. Unauthorized excavation, as well as remedial work directed by the Contractor, shall be at the Subcontractor's expense.

Structural: Excavations for such structures as footings, foundations, and slabs shall be made to the depths shown on the drawings and of sufficient width to allow adequate room for setting and removing forms, installing accessories, and inspection. Where concrete foundations or slabs are to be constructed on material other than rock, care shall be taken to prevent disturbing the bottom of the excavation. Excavation to final grade shall not be made until just before concrete forms are to be placed therein. Concrete foundations shall be placed only on undisturbed soil or rock.

Trenches: Trenches shall be of sufficient width to provide adequate room for workmen to perform any necessary service to the materials or items being installed therein and to permit proper compaction of the backfill.

Grade: The bottom of pipe trenches shall be graded to allow for a minimum of 4 in. of compacted sand bedding beneath the pipe. Bell holes shall be shaped so that pipe will be uniformly supported for its entire length on the compacted sand backfill. Hubs or flanges shall be unsupported until the pipeline has been tested, coated, and wrapped, as required.

Stockpiling and Disposal: Excavated material that is suitable and required for backfilling, grading, or topsoil shall be piled in an orderly manner a sufficient distance from the edge of the excavation, but in no case closer than 2 ft, and so located that it will not interfere with normal vehicular or pedestrian traffic. Excavated materials to be used for backfill shall be kept free from vegetation and other objectionable materials. Topsoil to be used for finish grading shall be kept free from subsoil, vegetation, and other objectionable materials and stones larger than 1 in. Excavated materials not required or not approved for

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backfilling, grading, or topsoil shall be disposed of. Unused excavated earth and rock waste and combustible materials shall be hauled to areas designated by the Contractor and disposed of in a manner specified in the Special Conditions.

Unstable Soil: If wet or otherwise unsatisfactory soil is encountered in an excavation, at or below the excavation line, it shall be brought to the attention of the Contractor and removed as directed in accordance with Article 38, "Differing Site Conditions," of the General Provisions. The bottom of the excavation then shall be brought to the required grade with concrete or compacted backfill as specified hereinafter. Excavation of unstable soil resulting from the Subcontractor's neglect to keep the excavated opening dry, and other over depth excavation not required to satisfactorily complete the work, shall be brought up to the required grade with concrete or compacted backfill as specified hereinafter at the Subcontractor's expense.

Shoring and Bracing: The sides of all excavations shall be sloped or securely shored and braced in accordance with 29 CFR 1926, Subpart P, "Excavations."

Control of Water: All excavations shall be kept free of standing water. The Subcontractor shall furnish, install, and operate the equipment required to keep excavations free from water at all times. Water shall be disposed of in a manner that will not cause injury to property.

Roads: Where excavations are required across roads or streets, one lane shall be kept open to traffic at all times unless otherwise directed. This shall be accomplished by excavating and backfilling only one-half of the road or street at one time.

BACKFILL OR FILL:

General: The excavations shall be cleared of all trash and debris prior to backfilling or filling. All backfill or fill material shall be free from trash, organic matter, and frozen particles. Backfilling or filling shall be done only when approved by the Contractor. In excavations that are shored, shoring and formwork shall be removed or raised as backfill or fill is placed. Protect existing graveled and paved areas used to temporarily store excavated materials to prevent soiling of graveled and paved areas. Restore graveled and paved areas to preconstruction condition.

Under Footings and Foundations: Footings and foundations for columns and for heavy equipment shall not be placed on earth backfill. Over depths in excavations for such footings and foundations shall be backfilled with concrete. The concrete shall be in accordance with the "Concrete" section of these specifications.

Under Slabs or Pavement: Backfill or fill materials under concrete slabs, floors, sidewalks, and concrete or asphalt pavement including fill for manholes shall be compacted fill material as specified in the "Materials" section, except that the last 2 in. of such fill shall be compacted leveling course material.

Pipelines and Buried Tanks: Bedding for piping and buried tanks shall be compacted sand or other approved granular material unless otherwise shown on the drawings. Bedding material shall extend from a minimum of 4 in. beneath the pipe or tank to a minimum cover of 4 in. The remainder of the trench or excavation shall be backfilled as specified hereinafter.

Trenching: The excavation contractor shall strip and stockpile for reuse all gravel in areas scheduled for excavation. Stockpiled materials shall be used to supply surface course in graveled areas.

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Overdepth Pipeline Excavation: Where pipe trenches are excavated to an overdepth due to the presence of rock, unstable soil or other unsuitable material, the overdepth shall be backfilled to required grade with compacted sand or other approved granular material. Overdepth excavation, unless approved in writing by the Engineer prior to excavation, shall be corrected as noted above at the Excavation Contractor's expense.

Placement: Concentrated dumping of backfill or fill material into excavations will not be permitted. No water shall be used for placing, settling, or compacting backfill or fill except to obtain optimum moisture content. All material must be placed in uniform layers not to exceed an 8-in. loose measurement and brought up simultaneously and evenly on both sides of foundation walls and around underground or covered structures and equipment such as culverts, manholes, storage tanks, and pipe. Backfill or fill around piping, and at least 4 in. over, shall be hand placed and compacted prior to pressure testing. Pipe joints shall be left exposed until leak testing has been completed. Care shall be taken when backfilling, filling, or compacting around any buried items or damp-proofed walls to prevent injury to the item being covered and to prevent piercing or rupturing the insulation, coating, or damp-proofing membrane. Loose backfill or fill may be placed as specified hereinafter.

Compaction: Unless otherwise indicated on the drawings or specifications, compact all backfill and fill material under slabs, roads, sidewalks, and other surfaced areas; around foundation walls; culverts; underground tanks; and other similar structures and to at least 4 in. compacted depth above all piping in trenches. Unless otherwise indicated, all "compacted" backfill or fill shall be compacted to at least 90% of maximum density at optimum moisture content as determined by AASHTO T99. The owner shall provide testing in accordance with AASHTO T238. Each 8-in., maximum, loose measurement lift shall be compacted before the next lift is placed thereon. The Contractor can measure compacted backfill or fill density and moisture content at any location and depth. Sections of backfill or fill failing to meet the minimum compaction requirements shall be corrected prior to placement of subsequent lifts. No heavy equipment shall be allowed within 5 ft of a structure or the foundation of any structure. No heavy equipment shall be allowed over piping until a minimum of 24 in. of backfill has been compacted over the piping.

Locator Ribbon: During the backfill and compaction operation, the locator ribbon shall be placed in a zone 6 to 12 in. from the ground surface directly over the utility.

FIELD QUALITY CONTROL:

The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

END OF SECTION 02200

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SECTION 02722--SANITARY SEWER PIPING

PART 1--GENERAL

WORK DESCRIPTION:

The Subcontractor shall furnish and install all equipment, materials, and supplies and perform all work and operations necessary for furnishing and installing the sanitary sewer piping and appurtenances, including septic tank and drainfield, complete as shown on the subcontract drawings and specified herein.

WORK INCLUDED: Work includes, but is not limited to:

Furnish and install sanitary sewer piping, fixtures, and accessories as shown on the subcontract drawings and as specified herein.

QUALITY CONTROL:

Codes and Standards: Comply with the requirements of the current revision of the following codes and standards, and as specified in this specification.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A74	“Standard Specification for Cast Iron Soil Pipe and Fittings”
ASTM A126	“Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings”
ASTM A193	“Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service”
ASTM A194	“Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both”
ASTM D2235	“Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings”
ASTM D2261	“Standard Test Method for Tearing Strength of Fabrics by Tongue (Single Rip) Procedure (Constant-Rate-of-Extension Tensile Testing Machine)”
ASTM D3350	“Standard Specification for Polyethylene Plastics Pipe and Fittings Materials”
ASTM F628	“Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core”
ASTM F810	“Standard Specification for Smoothwall Polyethylene (PE) Pipe for Use in Drainage and Waste Disposal Absorption Fields”
AWWA C104	“Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water”

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- 1 AWWA C110 "Ductile-Iron and Gray-Iron Fittings, 3"-48", for Water and Other Liquids"
2
3 AWWA C111 "Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and
4 Fittings"
5
6 AWWA C151 "Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for
7 Water or Other Liquids"
8

9 **SUBMITTALS:**

10
11 See Vendor Data Schedule.

12
13 **Shop Drawings:** Shop drawings shall include the following:

14
15 Principal dimensions and details of construction

16
17 Sizes and location of piping, septic tank, and components.

18
19 **Product Data:** Submit catalog data, specifications, and as-built drawings for each type of equipment
20 furnished.

21
22 **Certificates of Compliance:** Certificates of Compliance stating the type of cement used in manufacture of
23 precast concrete shall be submitted.

24
25 **PART 2--PRODUCTS**

26
27 **GENERAL:**

28
29 All material, products, and equipment shall be manufactured as specified in this section or approved
30 equals.

31
32 **Septic Tank and Fittings:**

33
34 Service: Receive sanitary waste.

35
36 Piping: All piping and appurtenances shall comply with requirements for ductile iron piping and
37 fittings of this section.

38
39 Materials: Septic tank shall be a precast concrete, 1,000-gal septic tank as approved for use in
40 southeast Idaho by Southeast Idaho Health Department, Blackfoot, ID,
41 phone (208) 785-2160.

42 Installation: Install tank level on undisturbed materials. Install in accordance with the
43 manufacturer's recommendations and Idaho code.

44
45 **Drainfield:**

46
47 Service: Ultimate disposal of sanitary waste.
48

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Materials: Infiltration chambers, Infiltrator 36 as supplied by Infiltrator Systems, Inc.
([800] 221-4436) or equal.

Installation: Install in accordance with the manufacturer's printed instructions and Idaho code. Do not backfill until the owner has inspected the system.

PIPE AND FITTINGS:

Ductile Iron (NR) Piping and Fittings:

Service: Sanitary Waste (WQ).

Piping: Piping shall be ductile iron pipe Class 531 in accordance with ASTM A74, "Standard Specification for Cast Iron Soil Pipe and Fittings," with rubber-gasketed mechanical push-on seal joints. Pipe shall be lined with cement-mortar and coated on the outside with coal tar (45 mil) or polyethylene (20 mil). Piping and coating shall be in accordance with AWWA C151, C111, and C104

Fittings: Fittings shall be 150# ANSI ductile iron, SCRD in accordance with AWWA C110 and C111 with ends to match piping.

ABS (NY) Piping and Fittings:

Service: Sanitary Waste (WQ) Vents.

Piping: Piping shall be Acrylonitrile-Butadiene-Styrene (ABS) plastic drain, waste, and vent pipe or ABS Schedule 40 plastic pipe with a cellular core in accordance with ASTM D2661 and F628. Use ABS solvent cement for joining pipe and fittings made to ASTM D2235.

Fittings: Fittings shall be ABS plastic DWV fittings, SCRD or solvent weld, or ABS Schedule 40 plastic DWV fittings with a cellular core, SCRD or solvent weld, in accordance with ASTM D2661 and F628.

FIXTURES, FITTINGS, AND TRIM:

Products shall be of the manufacturer set forth below or approved equals:

Cleanouts: Cleanouts shall be Model W-6030 cast iron cleanout with gasket hub outlet, cast iron plug as manufactured by Tyler Pipe or approved equal.

Floor Drain: Floor drain shall be a cast iron drain with integral trap, spigot side outlet integral cleanout plug, and flapper-type backwater valve. Drain shall be a Model W-1370 as manufactured by Tyler Pipe or approved equal.

Silicone Sealant: Sealant shall be Hilti Ciba-Geigy Firestop Sealant or approved equal.

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Identification Ribbon (Government-Furnished Equipment [GFE]): Identification ribbon shall be a minimum of 3 in. wide, with a message printed on the ribbon that identifies the actual pipeline contents. The plastic ribbon shall be color coded in conformance with the following:

<u>Category of Pipeline Contents</u>	<u>Tape Color</u>	<u>Lettering Color</u>
Sanitary Waste	Brown	White

Locator Ribbon (GFE): Locator ribbon shall be 3 in. in width with a message printed on the ribbon with bold black lettering that identifies the buried utility. The locator ribbon shall be color coded in accordance with the following:

<u>Category of Utility</u>	<u>Tape</u>	<u>Wording</u>
Pipelines	Yellow	"CAUTION BURIED PIPELINE BELOW"

PART 3--EXECUTION

INSTALLATION OF ALL SYSTEMS:

General:

Installation of all piping systems shall conform to the applicable requirements of the Uniform Plumbing Code.

PIPELINES:

Pipe shall be bedded in sand, 4 in. minimum in all directions, or other approved granular material, or insulation.

Install pipe to uniform pitches between points for which elevations are established. Use level or other approved method to accomplish this. Provide bends or elbows for changes in directions. One-quarter bends shall be long sweep type.

Between bends or elbows, lines shall be straight, free from irregularities, and have smooth interior surfaces.

Reducers shall be required for changes in the size of pipes and fittings. Bushings shall not be used.

Anchorage against slippage shall be provided by means of concrete or masonry piers, tie rods and pipe clamps, or other approved means. Joints shall be made accessible for inspection and repair prior to testing and backfilling.

Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and

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grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all superfluous materials.

Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints then shall be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.

Pipelines shall be installed in a neat and orderly manner. Installation shall avoid interference with work of the other trades.

Anchors and guides shall be provided, as required.

Pipes shall be full lengths to the greatest extent possible. Piping shall be cleaned of dirt, rust, scale, grease, and other foreign matter. Piping shall be kept clean as work progresses. Seal in accordance with underwriters requirements wherever piping passes through firewalls.

Roads: At primary access road or pavement crossings, sewer pipe shall be suitably encased in a sleeve of rigid conduit for the length installed under such facilities. It shall be of size and strength required for the anticipated superimposed loads. A minimum clearance of at least 2 in. between the inner diameter of the sleeve and the maximum outside diameter of the sleeved pipe, including the joints, shall be provided. Sand bedding shall be provided for the carrier pipe through the sleeve. Sleeves of ferrous material shall be provided with corrosion protection as required for the conditions encountered at the site of installation.

Structures: Where sewer pipe is required to be installed within 3 ft of an existing building or structural foundation, or penetrate a foundation wall, the sewer pipe shall be sleeved as specified above. Care shall be exercised and proper precautions taken during installation of the sewer pipe and sleeve to ensure that there will be no damage to such structures and no settlement or movement of foundations or footing. Any damage occurring as a result of the Subcontractor's operation shall be corrected and all costs connected there with shall be borne by the Subcontractor. When the sewer pipe location is within 3 ft of a proposed building, retaining wall, or structural foundation as stated above, the pipe shall be sleeved as required for an existing structure.

Pipe Joints: Mechanical joints shall be made in accordance with the manufacturer's requirements. Joints between concrete or cast iron fixtures and piping shall be sealed by filling the space between with silicone sealant or grout.

PIPE IDENTIFICATION:

All underground piping shall be wrapped with identification ribbon. All existing underground piping uncovered during construction shall be identified and wrapped with identification ribbon to the extents of the excavation. The ribbon shall be wrapped around the pipeline at no less than 1 wrap per 3 ft of run, with the pipe-identification labeling showing.

LOCATOR RIBBON:

Locator ribbon shall be placed in a zone 12 to 18 in. from the ground surface directly over the utility, including drainfield infiltrators, during the landfill and compaction operation.

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POTABLE WATER SEPARATION:

Potable water lines include only potable water (CW). Utility lines includes fire water (FW), raw water (RW), treated water (TW), demineralized water (DW), chilled water (CR and CS), cooling water (CWR and CWS), steam (LS & HS), condensate (CT), air lines (HA, HB, LA2, LA5, LH, L12, and L15), oxygen gas (ON), and nitrogen gas (NH). Process lines shall include all other process, waste, sanitary, and service lines.

Potable water lines shall be separated from other lines horizontally and vertically as specified below:

Potable water lines shall be separated from process lines by a minimum of 10 ft horizontally, or; separated by 6 ft horizontally and 18 in. vertically and the process line shall be constructed as a minimum to the requirements of the water line, or encased in 4 in. minimum of concrete all around, or double encased in welded Schedule 40 carbon steel or polyethylene pipe sealed at both ends.

Where potable water and process piping cross, the pipes shall be separated as specified below:

The potable water line shall be separated from process lines by a minimum of 18 in. vertically (top of process pipe to bottom of potable water pipe).

The water line shall be centered so that the joints will be equal distance and as far as possible from the crossed line.

The process line shall be constructed as a minimum to the requirements of the water line, or either line shall be encased in 4 in. minimum of concrete all around, or double encased in welded Schedule 40 carbon steel or polyethylene pipe sealed at both ends with 10 ft on both sides of the crossing.

At any point where a process pipe crosses above the water pipe, the process pipe shall be supported to prevent settling.

CLEANSING AND TESTING:

All piping systems shall be cleaned and tested, as detailed in this specification, and shall be witnessed by the Contractor's Representative.

FIELD QUALITY CONTROL:

The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

END OF SECTION 02722

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SECTION 03300—CAST-IN-PLACE CONCRETE

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

Footings and foundations
Slabs and floors
Precast trench drain and sump system
Walks, ramps, and paving
Conduit encasement.

Related Sections: The following sections contain requirements that relate to the work of this section:

Section 02200, "Earthwork," for drainage base course under slabs, floors, walks, and paving
Section 05100, "Structural Steel and Miscellaneous Metals," for cast-in anchors and embedded structural steel fabrications.

REFERENCES:

The following documents, including others referenced therein, form part of this section to the extent designated herein:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C94 "Standard Specification for Ready-Mixed Concrete"

The following ASTM specifications are referenced in regard to materials:

ASTM A615 "Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement"
ASTM C33 "Standard Specification for Concrete Aggregates"
ASTM C150 "Standard Specification for Portland Cement"
ASTM C260 "Standard Specification for Air-Entraining Admixtures for Concrete"
ASTM C309 "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete"
ASTM C494 "Standard Specification for Chemical Admixtures for Concrete"
ASTM C618 "Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete"

The following ASTM standards shall be used by the inspecting agency for concrete tests or inspections:

ASTM C 31 "Standard Practice for Making and Curing Concrete Test Specimens in the Field"
ASTM C39 "Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens"
ASTM C143 "Standard Test Method for Slump of Hydraulic Cement Concrete"

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ASTM C172 "Standard Practice for Sampling Freshly Mixed Concrete"
ASTM C231 "Standard Test Method for Air Content of Freshly Mixed Concrete by the
Volumetric Method"

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117 "Standard Specifications for Tolerances for Concrete Construction and
Materials"
ACI 301 "Specifications for Structural Concrete for Buildings"
ACI 305 "Hot Weather Concreting"
ACI 306.1 "Standard Specification for Cold Weather Concreting"
ACI 318 "Building Code Requirements for Reinforced Concrete"
ACI 347 "Guide to Formwork for Concrete"

CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

U.S. DEPT. OF COMMERCE, NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

DOC PS 1 "Product Standard for Construction and Industrial Plywood"

SUBMITTALS:

Submittals for Review:

Concrete Placements: Submit final list of concrete placements for which air entrainments is not required
prior to construction start for approval.

Mix Design: Submit final mix design for each grade of concrete used prior to construction start for
approval.

Submittals for Information:

Batch Tickets: Supply copies of the batch ticket with each load of concrete as completed for information.

Submittals for Project Closeout:

None.

QUALITY CONTROL:

Comply with provisions of ACI 301 unless otherwise specified herein.

PART 2--PRODUCTS

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1 FORM MATERIALS:

2
3 Forms for Exposed Finish Concrete: Provide continuous, straight, smooth, and exposed surfaces. Furnish
4 in largest practicable sizes to minimize number of joints. Provide form material with sufficient thickness
5 to withstand pressure of newly placed concrete without visible bow or deflection:
6 Plywood shall comply with American Plywood Association, grade "EXT-DFPA PLYFORM" or better.

7
8 Where extra degree of smoothness is required, plywood shall comply with U.S. Product Standard PS-1
9 "B-B High Density Overlaid Concrete Form," Class I.

10
11 Forms for Unexposed Finish Concrete: Form concrete surfaces that will be unexposed in finished
12 structure with plywood, lumber, or metal. Provide lumber dressed on at least two sides and one side for
13 tight fit.

14
15 Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain,
16 nor adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

17
18 Chamfer Strips: Wood, metal, PVC, or rubber strips—3/4 by 3/4-in. minimum, unless otherwise
19 indicated.

20
21 Form Ties: Factory-fabricated, removable, or snap-off metal or glass-fiber-reinforced plastic form ties
22 designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on
23 removal. Furnish units that will leave no corrodible metal closer than 1 in. to the plane of the exposed
24 concrete surface. Furnish ties that, when removed, will leave holes not larger than 1 in. in diameter in
25 concrete surface.

26
27 STEEL REINFORCING MATERIALS:

28
29 Reinforcing Bars: ASTM A 615, Grade 60 deformed, as indicated on the drawings. Grade 40 may be used
30 for No. 4 and smaller ties.

31
32 Bar Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers,
33 and other devices for spacing, supporting and fastening reinforcing in place. Use wire bar-type supports
34 complying with CRSI recommendations or approved substitute. Where base material will not support
35 chair legs, use supports with sand plates or horizontal runners. Pumice blocks, adobe, bricks, rocks, etc.
36 are not acceptable for rebar or wire mesh supports.

37
38 Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with the ends square
39 and free of burrs.

40
41 CONCRETE MATERIALS:

42
43 Portland Cement: Cement shall conform to ASTM C150, "Standard Specification for Portland Cement,"
44 Type I-II. The cement shall contain no more than 0.60% by weight of alkalis calculated as
45 ($\text{Na}_2\text{O} + 0.658 \text{K}_2\text{O}$).

46
47 Aggregate: Fine and coarse aggregate shall conform to ASTM C33, "Standard Specification for Concrete
48 Aggregates." Maximum coarse aggregate size shall conform to ACI 318 Paragraph 3.3.2. Unless
49 otherwise specified, maximum aggregate size shall be 1-1/2 in.

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1 Mixing Water: Potable water having no pronounced taste or odor and containing no deleterious materials.

2
3 Air-Entraining Agents (AEA): ASTM C260, "Standard Specification for Air-Entraining Admixtures for
4 Concrete."

5
6 High-Range Water-Reducing Admixture (Superplasticizer): If a superplasticizer is used, it shall conform
7 to ASTM C494, "Standard Specification for Chemical Admixtures for Concrete," Type F.

8
9 Water-Reducing Admixtures: If water-reducing admixtures are used they shall conform to ASTM C494,
10 "Standard Specification for Chemical Admixtures for Concrete," Type A; and they should contain no
11 more than 1% chloride ions.

12
13 Calcium Chloride: Calcium chloride is not permitted.

14
15 Pozzolans: Pozzolans (fly ash) shall conform to ASTM C618, "Standard Specification for Coal Fly Ash
16 and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete," Class F; except that
17 the loss on ignition (LOI) shall be less than 2%.

18
19 RELATED MATERIALS:

20
21 Nonshrink Grout: Provide one of the following or approved equal:

22
23 "Masterflow 713;" Master Builders
24 "SonogROUT;" Sonneborn Building Products
25 "Five Star Grout;" U.S. Grout Co.

26
27 Curing Compound: Curing compound or curing-hardener-sealer compound shall comply with
28 ASTM C309, "Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete,"
29 Type I, Class A.

30
31 The compound shall be compatible with adhesives, paint, and floor coating systems if it is to be applied in
32 areas to receive these materials. The number of coats shall be as recommended by the manufacturer;
33 however, in any case, floor slabs to be left exposed shall receive at least a second coat just after final
34 cleanup. Comply with the requirements for preparation of finishing systems specified in other sections of
35 this specification, including omission of curing compound if required for finishing systems installation.

36
37 Bonding Compound: Provide one of the following or approved equal:

38
39 "Everbond" L & M Construction Chemical Corporation
40 "Sikabond" Sika Corporation
41 "Sonocrete" Sonneborn Building Products
42 "Weld-Crete" Larsen Products Corporation.

43
44 Joint-Sealing Compound: Provide a polyurethane joint sealant material.

45
46 Expansion Joint Material: Provide 1/2-in. asphalt-impregnated fibrous expansion material.

47
48 Red Coloring for Electrical Duct Encasement: Commercial grade red iron oxide, 3 lb per sack of cement.

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PROPORTIONING AND DESIGN OF MIXES:

Mix Design: Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 318.

Design mixes to provide normal weight concrete with the following specified 28-day compressive strengths, minimum, as indicated on drawings and schedules:

- Class 20: 2,000 psi (for conduit encasement)
- Class 25: 2,500 psi (for over-depth excavation fill)
- Class 40: 4,000 psi (structural concretes, foundation, and sidewalks).

See FIELD QUALITY CONTROL of this specification for acceptance criteria.

The Subcontractor may request adjustment to concrete mixes when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Revised mix designs must be submitted and approved prior to use.

The concrete mix shall contain a pozzolan (fly ash) unless otherwise approved by the Contractor's Representative.

Concrete in hard-to-place locations shall utilize a high-range water reducer. No other water-reducer shall be used with a high-range water reducer.

Durability: Concrete that will be subject to freezing and thawing, weathering, or deicer chemicals shall be air-entrained. Add air-entraining agent (AEA) at the manufacturer's prescribed rate to result in concrete at point of placement having air content within the following limits:

Maximum Aggregate Size (in.)	Air Content (Percent)	
	Severe Exposure	Moderate Exposure
1/2	5-1/2 to 8-1/2	4 to 7
3/4	4-1/2 to 7-1/2	3-1/2 to 6-1/2
1	4-1/2 to 7-1/2	3 to 6
1-1/2	4 to 7	3 to 6

The Subcontractor shall submit a list of all concrete placements for which air entrainment is not required for review and approval.

Concrete that will be subject to deicer chemicals or freezing and thawing in a moist condition shall have a minimum 28 days compressive strength of 4,500 psi and a maximum water-cementitious materials ratio of 0.45.

Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:

Reinforced foundations: 3 in. \pm 1 in.

Slabs and other structural concrete: 3-1/2 in. \pm 1-1/2 in.

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1 Red concrete for conduit encasement: not less than 3 in. and not more than 6 in.

2
3 Maximum slump for concrete using a high-range water reducer may be increased to 8 in. at point of
4 placement.

5
6 MIXING AND DELIVERY:

7
8 The manufacture and delivery of all concrete shall conform to ASTM C94, "Standard Specification for
9 Ready-Mixed Concrete," except as modified herein. Hand-mixed concrete is prohibited.

10
11 When concrete arrives at the job site with slump below that suitable for placement, as indicated by the
12 specification, water may be added only if the maximum permissible water-cement ratio and the maximum
13 permissible slump is not exceeded. Any water added to bring the slump within required limits shall be
14 injected in such a manner that uniformity requirements are met. Water shall be incorporated by additional
15 mixing equal to at least half of the total mixing required or 30 drum revolutions at rated mixing speed,
16 whichever is more. Additional AEA may be introduced during this mixing period, if necessary, to meet
17 specifications. Neither water nor AEA shall be added to the batch at any later time.

18
19 Concrete uniformity shall meet the requirements of ASTM C94, "Standard Specification for Ready-
20 Mixed Concrete," except as modified herein. Visible lumps, nonconformance to uniformity requirements,
21 or failure to meet specified slump, entrained air and temperature requirements shall be considered cause
22 for rejecting the remainder of the load after final mixing is complete. In addition, failure of the ready-mix
23 truck drum to meet uniformity requirements will be deemed cause for rejection of the mixing equipment
24 until adequate repairs have been made.

25
26 Discharge of the concrete shall be completed within 1.5 hours or before the drum has revolved
27 300 revolutions, whichever comes first, after the introduction of mixing water to the cement and
28 aggregates. The Contractor may extend this 1.5-hour limit if the concrete still meets all specified
29 requirements after 1.5 hours. (Additional testing to verify conformance to specifications may be
30 necessary.) In hot weather or under conditions contributing to quick stiffening of the concrete, the
31 Contractor may designate a time limit less than 1.5 hours.

32
33 High-range water-reducing admixtures (superplasticizer) shall be added to the mixer at the job site and
34 then be allowed to mix for at least 5 minutes.

35
36 Concrete that is rejected for failure to meet any of the above requirements will be evaluated by the
37 Contractor and may be removed and replaced at the expense of the Subcontractor.

38
39 Hot or Cold Weather Concreting: Methods and means of batching, mixing, and delivery of concrete in hot
40 or cold weather shall comply with ACI-301 or ACI-306.1.

41
42 SOURCE QUALITY CONTROL:

43
44 The Subcontractor shall provide the necessary testing and monitoring to qualify proposed materials and
45 establish mix designs.

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1 PART 3--EXECUTION

2
3 FORMS:

4
5 Unless otherwise shown on the drawings, all forms shall be straight and plumb, rigid, and mortar tight.
6 All forms shall be braced, tied, and supported sufficiently to maintain their required position during and
7 after the placement of concrete. Joints shall be sufficiently tight to prevent mortar leakage. Where shown
8 on the drawings, suitable moldings shall be placed in forms to shape edges or surfaces of concrete
9 members. All formwork shall conform to the guidelines in ACI 347.

10
11 All exposed corners of concrete shall be chamfered 1 in.

12
13 Form Ties: Use factory-fabricated, adjustable-length, removable, or snap-off metal form ties that are
14 designed to prevent form deflection and to prevent spalling concrete surface upon removal.

15
16 Unless otherwise indicated, provide ties so those portions remaining within concrete after removal will
17 not be within 1 in. of any exposed concrete surface.

18
19 Form ties for walls subject to hydrostatic pressure shall have water seals.

20
21 Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other
22 trades.

23
24 Tolerances: Unless otherwise noted on the drawings, formwork shall be constructed so that the concrete
25 surfaces conform to the tolerance limits listed in ACI 117.

26
27 Preparation of Form Surfaces: Coat contact surfaces of forms with a form-coating compound before
28 reinforcement is placed. Do not allow form-coating compound to come into contact with reinforcement or
29 with concrete surfaces against which fresh concrete will be placed.

30
31 PLACING REINFORCEMENT:

32
33 Clean loose rust and mill scale, earth, ice, and other materials from the reinforcement that reduce or
34 destroy the bond with concrete.

35
36 Accurately position, support, and secure the reinforcement against displacement by formwork,
37 construction, or concrete placement operations.

38
39 Place the reinforcement to obtain at least minimum coverage for concrete protection. Unless otherwise
40 indicated, reinforcement position shall be as necessary to meet coverage, spacing, and placement
41 requirements specified in ACI 318, Chapter 7.

42
43 Unless otherwise shown on the drawings, splicing of reinforcement shall be in accordance with ACI 318,
44 Chapters 7 and 12. Unless otherwise indicated on the drawings, all splices shall be Class B tension splices
45 for regular bars.

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JOINTS:

Construction Joints: Locate and install construction joints, when not shown on drawings, so as not to impair strength and appearance of the structure, and as acceptable to the Contractor's Representative.

Provide keyways at least 1-1/2 in. deep in all construction joints, unless otherwise noted.

Isolation (Expansion) Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs on ground and vertical surfaces, such as column pedestals, foundations walls, and as indicated on the drawings. Provide expansion joint material in all isolation joints. Material shall be placed 1/2 in. below slab elevation and extend the full depth of the slab.

Control Joints (Contraction) in Slabs-on-Ground: Construct control joints as shown on the drawings. Joints shall be sealed with a polyurethane sealant material in accordance with the manufacturer's recommendation. Saw cutting shall conform to ACI 301, Section 11.5.

Asphalt and Slabs-On-Ground Interface: Sawcut existing asphalt where concrete and existing asphalt pavement are to meet in order to provide a straight, clean joint.

INSTALLATION OF EMBEDDED ITEMS:

Set and build into work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Secure all such items firmly in position.

CONCRETE PLACEMENT:

Preplacement Inspection: Completed formwork, reinforcing steel, and items to be embedded shall be inspected and approved prior to placement. However, such approval shall in no way release the Subcontractor from responsibility for acceptable and satisfactorily completed work. For concrete cast against soil, the soil shall be free from frost or ice and shall be wetted down before placement.

Placing Concrete in Slabs-on-Ground: Except at joints as shown on the drawings, place concrete for slabs-on-ground, including integral curbs, in monolithic pours without joints.

Placing Concrete in Forms: The concrete shall be deposited continuously in horizontal layers not more than 2 ft in depth, with each succeeding layer placed before the preceding layer has reached its initial set.

Consolidation: During and immediately after placement, all concrete shall be consolidated sufficiently to provide thorough placement around all reinforcement, embedded items, and into corners of forms without segregating the mix. Vibration shall penetrate the placed layer and at least 6 in. into the preceding layer. Do not use vibrators to move concrete inside the forms. A spare vibrator shall be on hand at the job site and available to substitute for any other vibrator that fails during placement.

Dropping of Concrete: Maximum allowable free vertical drop shall be 5 ft, but dropping of concrete from this height through reinforcement (as in columns and walls), or other conditions causing segregation, shall be avoided. For drops greater than 5 ft, a confining device shall be used, subject to the approval of the Contractor.

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Cold Weather Placing: Protect concrete work from damage or reduced strength that could be caused by frost, freezing, or low temperatures, in compliance with ACI 306 and as specified herein. Minimum concrete temperature as placed and maintained shall be 55°F or as required by ACI-306, Table 3.1, Line 1.

Hot Weather Placing: When hot weather conditions that would seriously impair quality and strength of concrete exist, place concrete in compliance with ACI 305 and as specified herein:

Cool the mixing drum and/or ingredients before mixing to maintain concrete temperature below 95°F at time of placement.

FINISH OF FORMED SURFACES:

Rough Form Finish (RfFm): Provide as-cast rough form finish to formed concrete surfaces that are to be concealed in finish work or by other construction, unless otherwise indicated.

Standard rough form finish shall be the concrete surface having the texture imparted by the form facing material used, with tie holes and defective areas repaired and patched and all fins and other projections exceeding 1/4 in. in height rubbed down or chipped off.

Smooth Form Finish (SmFm): Provide as-cast smooth form finish for formed concrete surfaces that are exposed-to-view, or that are covered with a coating material applied directly to concrete, or a covering material bonded to concrete such as waterproofing, damp-proofing, painting, or other similar system.

Produce smooth form finish (SmFm) by selecting form material to impart a smooth, hard, and uniform texture and arranging them orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.

Related Unformed Surfaces: At tops of curbs, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with texture matching adjacent formed surfaces.

SLAB FINISHES:

Float Finish (Flt): Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes, as hereinafter specified, and slab surfaces that are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, and as otherwise shown on drawings or in schedules.

After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats or both. Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 1/4 in. in 10 ft when tested with a 10-ft straightedge placed on the surface at not less than two different angles. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float the surface to a uniform, smooth, and granular texture.

Trowel Finish (Trw): Apply trowel finish to monolithic slab surfaces to be exposed to view, unless otherwise indicated, and slab surfaces to be covered with paint or other thin-film finish coating system.

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After floating, begin first trowel finish operation using power-driven trowel. Begin final troweling when surface produces ringing sound as trowel is moved over surface.

Consolidate concrete surface by final hand troweling operation, free of trowel marks, uniform in texture and appearance, and with surface plane tolerance not exceeding 1/8 in. in 10 ft when tested with a 10-ft straightedge.

Nonslip Broom Finish (Brm): Apply nonslip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as shown on drawings or in schedules.

Immediately after float finishing, slightly roughen concrete surface by brooming in direction perpendicular to main traffic route.

CONCRETE CURING AND PROTECTION:

General: Protect freshly placed concrete from injurious action by sun, rain, wind, flowing water, mechanical injury, and premature drying for not less than 7 consecutive days after placement.

Protect concrete against damage from frost or freezing for a minimum of 3 days. Provisions of ACI 306.1 shall apply for cold weather, unless otherwise specified.

Alternatively, if tests are made of cylinders kept near the structure and cured by the same methods, moisture retention measures may end when the average compression strength has reached 70% of the specified strength. Other alternatives such as those given in ACI 301, 12.2.3 also may be used if approved by the Contractor.

Early Loading of New Concrete: Early loading of concrete structures shall comply with requirements of ACI 318, Section 6.2. When construction loading is proposed before concrete has achieved its 28-day design strength, structural calculations and concrete strength test data shall be submitted and approved prior to loading.

Curing Methods: Perform curing of concrete by one or more of the following methods:

Moist Curing: Cover concrete surfaces with moisture-retaining cover for curing period. Exposed horizontal concrete surfaces may be covered with sand or other approved material and kept wet for the required period. Wood forms shall be kept sufficiently wet at all times to prevent the forms from separating at the joints and the concrete from drying.

Membrane Curing: Concrete surfaces to receive membrane curing shall be treated with a curing compound as specified or otherwise approved. The curing compound shall be applied in strict accordance with the compound manufacturer's directions.

Temperature, Wind, and Humidity:

Cold Weather: When the mean daily outdoor temperature is less than 40°F, the temperature of the concrete surface shall be maintained between 55 and 90°F for the required curing period. When necessary, arrangements for heating, covering, insulating, or housing the concrete work shall be made in advance of placement and shall be adequate to maintain the required temperature without injury due to concentration of heat. Combustion heaters shall not be used during the first 24 hours unless precautions

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are taken to prevent exposure of the concrete to exhaust gases that contain carbon dioxide. If early loading is anticipated during cold weather, provide temperature protection to ensure necessary strength development.

The concrete surface temperature requirements (based on section thickness) in ACI 306.1 may be used in lieu of the 55°F minimum specified before.

If concrete surface temperatures as measured by the inspecting agency are below the minimum curing temperature but meet the freeze protection requirements, the concrete curing period shall be extended to ensure that adequate strength is developed. The extension time shall be at least equivalent to the time period in which temperatures were too low.

Hot Weather: The concrete surfaces shall be kept below 100°F for the curing period. When necessary, provision for windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light-colored material shall be made in advance of placement, and such protective measures shall be taken as quickly as concrete hardening and finishing operations will allow.

Rate of Temperature Change: Changes in temperature of the air immediately adjacent to the concrete during and immediately following the curing period shall be kept as uniform as possible and shall not exceed 5°F in any 1-hour or 50°F in any 24-hour period.

REMOVAL OF FORMS:

Formwork Not Supporting Weight of Concrete: This formwork may be removed after cumulatively curing at not less than 50°F for 32 hours after placing concrete, provided concrete is sufficiently hard not to be damaged by form removal or subsequent operations. Curing then must continue through the minimum curing period.

Formwork Supporting Weight of Concrete: This formwork may not be removed until concrete has attained its 28-day design compressive strength, except as permitted under "Early Loading of New Concrete."

CONCRETE SURFACE REPAIRS:

All porous and fractured concrete shall be repaired. Surface defects may be repaired by patching. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, snap-tie holes, and other projections on the surface. The Contractor shall approve all repairs. Alternate repair methods not specified may be used if approved by the Contractor.

Patch Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when approved by the Contractor. Cut out honeycomb, rock pockets, and voids over 2 in. in any dimension. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding agent has dried.

Repair defects in concrete exceeding 2 in. in diameter by removing defective areas, cleaning, treating with bonding agent, and replacing with new concrete.

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1 **FIELD QUALITY CONTROL:**

2
3 **Subcontractor-Supplied Testing:** The Subcontractor shall provide the necessary testing and monitoring
4 services for the following:

5
6 Testing services needed by the Subcontractor to control or monitor the production, transportation,
7 placement, protection, curing, or temperature of the concrete

8
9 The use of Contractor-supplied inspection or testing services shall in no way relieve the Subcontractor of
10 the responsibility to furnish materials and construction in full compliance with the subcontract
11 documents.

12
13 **Contractor-Supplied Testing:** The Contractor's Representative will perform tests during placement and
14 curing of the concrete. Monitoring of concrete protection and curing methods also will occur.

15
16 Sampling and testing for quality control during placement of concrete will include the following:

17
18 **Sampling Fresh Concrete:** ASTM C172, "Standard Practice for Sampling Freshly Mixed Concrete,"
19 except modified for slump to comply with ASTM C94, "Standard Specification for Ready-Mixed
20 Concrete."

21 **Slump:** ASTM C143, "Standard Test Method for Slump of Hydraulic Cement Concrete."

22 **Air Content:** ASTM C231, "Standard Test Method for Air Content of Freshly Mixed Concrete by
23 the Volumetric Method."

24 **Concrete Temperature:** Test when air temperature is 40°F or below, or when 90°F or above, and at
25 any other times as selected by the Contractor.

26
27 **Concrete Uniformity Test for Adequacy of Mixing Equipment:** ASTM C94, "Standard Specification for
28 Ready-Mixed Concrete."

29
30 **Compression Test Specimen:** ASTM C31, "Standard Practice for Making and Curing Concrete Test
31 Specimens in the Field," one set of two standard cylinders for each compressive strength test, unless
32 otherwise directed.

33
34 **Subsequent tests may include:**

35
36 **Compressive Strength Tests:** ASTM C39, "Standard Test Method for Compressive Strength of
37 Cylindrical Concrete Specimens," frequency of testing shall comply with ACI 318, Chapter 5,
38 Section 5.6, unless otherwise directed.

39
40 Strength level of an individual class of concrete shall be considered satisfactory if both of the following
41 requirements are met:

42
43 Average of all sets of three (or less if three are not available) consecutive strength tests equal or exceed
44 the specified 28-day compressive strength.

45
46 No individual strength test (average of two cylinders) falls below the specified 28-day compressive
47 strength by more than 500 psi.
48

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1 Inspection or test results not conforming to the stated requirements of this specification shall be reported
2 to the Operating Contractor's Project Manager for evaluation and disposition with the concurrence of the
3 Architect/Engineer.

4
5 Nondestructive Tests: Testing by impact hammer, sonoscope, or other nondestructive device may be
6 performed to determine relative strengths at various locations in the structure as an aid in evaluating
7 concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and
8 correlated with other test data, shall not be used as a basis for acceptance or rejection of the concrete.
9

10 Surveillance will be performed by the Contractor's Representative to verify compliance of the work to the
11 drawings and specifications.

12
13 END OF SECTION 03300

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SECTION 05100--STRUCTURAL STEEL AND MISCELLANEOUS METALS

PART 1--GENERAL

SUMMARY:

The Subcontractor shall supply all labor, equipment, and materials required to construct items listed hereafter and as shown on the drawings.

Section Includes: Work includes, but is not limited to:

Structural steel framing
Structural steel pipe supports
Structural steel equipment supports or platforms
Miscellaneous steel such as guard posts, bollards, anchors, and embedments

Related Sections: The following sections contain requirements that relate to the work of this section:

Section 03300, "Cast-In-Place Concrete," for grouting and cast-in-place anchoring structural steel and miscellaneous metals to concrete
Section 09900, "Painting," for shop painting structural steel and miscellaneous metals
Section 13120, "Metal Building Systems"
Section 15025, "Welding"

REFERENCES:

The following documents including others referenced therein, form part of this section to the extent designated herein.

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC "Code of Standard Practice for Steel Buildings and Bridges"

AISC (ASD) "Specification for Structural Steel Buildings - Allowable Stress Design (ASD) and Plastic Design"

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z49.1 "Safety in Welding"

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 "Structural Welding Code – Steel"

AWS D1.3 "Structural Welding Code - Sheet Steel"

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RESEARCH COUNCIL ON STRUCTURAL CONNECTIONS

RCSC "Specification for Structural Joints Using ASTM A325 or A490 Bolts"

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC SP-7 "Brush-off Blast Cleaning"

SSPC Paint 25 "Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)"

The following specifications are referenced in regard to materials:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A36 "Standard Specification for Carbon Structural Steel"

ASTM A53 "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless"

ASTM A307 "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength"

ASTM A325 "Standard Specification for Bolts, Steel, Heat-Treated, 120/105 ksi Minimum Tensile Strength"

ASTM A490 "Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength"

ASTM A500 "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes"

ASTM A572 "Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel"

ASTM A653 "Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process"

ASTM A924 "Standard Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot Dip Process"

ASTM A1008 "Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"

ASTM B209 "Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate"

SUBMITTALS:

Welding: Welding submittals shall be in accordance with Section 15025, "Welding."

Submittals for Review:

Shop Drawings: Submit copies of shop drawings—including all shop and erection details, members (with their connections), and templates required for coordination with work of other sections—for approval prior to fabrication release. All welds shall be indicated by standard welding symbols of AWS D1.1.

Erection: Prior to erection, submit copies of erection plans of the structural steel framing for approval. This erection plan shall conform to the requirements of AISC Code of Standard Practice. The erection plan shall describe all necessary temporary supports, including the sequence of installation and removal. Plan shall show sufficient detail and instructions to ensure that the structure has been evaluated for stability throughout the contract.

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Materials: Submit copies of certified copies of mill test reports for high-strength bolts, heavy-hex nuts, and flat washers for approval prior to purchase.

Procedures: Submit copies of procedures for tightening of "slip-critical" bolts for approval prior to purchase. The procedure shall include necessary materials, tightening methods, and inspection methods or criteria if direct tension indicator tightening is used.

Samples: Submit three high-strength bolt, nut, and washer assemblies from each lot supplied for examination, testing, and approval by the Contractor prior to installation. The assemblies shall be a random sample selected by the Contractor's Representative.

Submittals for Information: None.

Submittals for Project Closeout: None.

QUALITY CONTROL:

Qualification for Welding Work:

Off-Site: Qualify welding processes and operators for shop welding in accordance with AWS D1.1.

On-Site: Qualify welding operators for on-Site (field) welding in accordance with the *INEEL Welding Manual*. On-Site welding will be performed to WPS C3.5 or C6.10, as applicable. All welders shall be qualified at the INEEL Welder Test Facility.

DELIVERY, STORAGE, AND HANDLING:

Store material to permit easy access for inspection and identification. Protect members and materials from corrosion and deterioration.

Do not store materials in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials that do not meet these specifications.

PART 2--PRODUCTS

MATERIALS:

Structural Steel Shapes: ASTM A36/A572, "Standard Specification for Carbon Structural Steel"/"Standard Specification for High-Strength Low-Alloy Columbium Vanadium Structural Steel," Grade 50, except where other type steel is indicated.

Miscellaneous Steel Plates and Bars: ASTM A36, "Standard Specification for Carbon Structural Steel," except where other steel type is indicated.

Cold-Formed Steel Tubing: ASTM A500, "Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes," Grade B.

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1 Steel Pipe: ASTM A53, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated,
2 Welded and Seamless," Type E or S, Grade B.

3
4 Anchor Bolts: ASTM A307, "Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile
5 Strength."

6
7 Shoulder Eye Bolts: Steel, 19,600-lb minimum working-load capacity, 1.5-in. diameter shank, and 2.5-in.
8 diameter inside dimensioned eye for welded connection. Provide Buckeye Forge Model No. 3150, as
9 supplied by Boise's Rigging Supply, Boise, Idaho, phone (208) 342-8919, or approved equal.

10
11 Unfinished Threaded Fasteners: ASTM A307, "Standard Specification for Carbon Steel Bolts and Studs,
12 60,000 psi Tensile Strength," Grade A, regular hexagon type, low carbon steel.

13
14 High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened
15 washers, as follows:

16
17 Quenched and tempered medium-carbon steel, bolts, nuts and washers, complying with
18 ASTM A325, "Standard Specification for Bolts, Steel, Heat-Treated, 120/105 ksi Minimum
19 Tensile Strength," or A490, "Standard Specification for Structural Bolts, Alloy Steel, Heat
20 Treated, 150 ksi Minimum Tensile Strength," Type 1.

21
22 Direct tension indicators shall be DTI Smartbolts as made by Stress Indicators, Inc.,
23 6307 Wiscasset Road, Bethesda, Maryland 20816, phone (240) 631-7246., or approved equal.

24
25 Concrete Anchors: Concrete anchors shall be wedge anchors as manufactured by one of the following
26 manufacturers or approved equal:

27
28 "Red Head" by ITT Phillips Drill Company
29 "Hilti Kwik-Bolt II" by Hilti Inc.

30
31 Electrodes: Comply with AWS D1.1 for shop welding. Comply with INEEL weld procedures indicated
32 for field welding.

33
34 Structural Steel Primer Paint: Primer shall conform to Section 09900, "Painting."

35
36 Compressible Seals: Closed-cell, neoprene or ethylene propylene diene terpolymer (EPDM) strips or
37 sheet, of size as indicated, with compatible adhesive joint sealant.

38
39 **FABRICATION:**

40
41 Shop Fabrication and Assembly: Fabricate items of structural steel in accordance with AISC ASD
42 specification.

43
44 Fabrication and assembly shall be done in the shop to the maximum extent possible.

45
46 Connections: Weld or bolt shop connections, as indicated. Bolt field connections, except where welded
47 connections are indicated. Provide 3/4-in. diameter "slip-critical" high-strength threaded fasteners for
48 bolted connections, except where otherwise indicated. Install high-strength threaded fasteners in

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accordance with Specification for Structural Joints using ASTM A325 or A490 bolts. Acceptable methods for tightening of "slip-critical" bolts are limited to direct tension indicator tightening, turn-of-nut tightening, installation of alternate design bolts, and calibrated wrench tightening.

Weld Construction: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.

SHOP PAINTING:

General: Comply with requirements of Section 09900, "Painting." Shop prime structural steel, except the following:

Surfaces embedded in concrete, grout, or mortar. Extend priming of partially embedded members to a depth of 2 in.

Surfaces to be field welded or to be high-strength bolted with slip-critical condition.

Surface Preparation: Clean the surfaces to be painted after inspection and before shipment. Remove loose rust, loose mill scale, and splatter, slag, or flux deposits. Prepare surfaces according to SSPC SP-7 "Brush-off Blast Cleaning," unless otherwise indicated in Section 09900.

Priming: Immediately after surface preparation, apply primer coats in accordance with manufacturer's instructions and Section 09900, "Painting." Apply primer at the rate recommended by SSPC to provide primer dry film thickness not less than 1.5 mil. Stripe the paint corners, crevices, bolts, welds, and sharp edges. Apply two coats of prime paint to surfaces that are inaccessible after assembly or erection; change second coat color to distinguish from first.

PART 3--EXECUTION

ERECTION:

Surveys: Check elevations of concrete-bearing surfaces and locations of anchor bolts and similar devices before erection work proceeds, and report discrepancies to the Contractor. Do not proceed with erection until corrections have been made or until compensating adjustments have been agreed upon with the Contractor.

Temporary Shoring and Bracing: Provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads.

Anchor Bolts: Furnish anchor bolts and other connectors required for securing steel to foundations and other in-place work. Furnish templates and other devices as necessary for presetting bolts and anchors to accurate locations.

Field/Shop Assembly: Set structural steel accurately to lines and elevations indicated. Align and adjust various members before permanently fastening. Clean the surfaces that will be in contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

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Level and plumb individual members of the structure within specified AISC Code of Standard Practice tolerances, except as indicated otherwise.

Field Connections: Do not use gas cutting in field for correcting fabrication errors in structural framing:

Bolted Connections: Install high-strength threaded fasteners in accordance with specifications for structural joints using ASTM A 325 or A 490 bolts. All connections using high-strength threaded fasteners shall be considered "slip-critical" unless otherwise indicated.

Field Welding: Field welding shall be done in accordance with the AWS D1.1, the *INEEL Welding Manual*, and applicable INEEL Welding Procedures C-2.11, C-3.5, C-6.9, or C-6.10.

FIELD QUALITY CONTROL:

Contractor-Supplied Testing: The Contractor's Representative will inspect high-strength bolted connections and welded connections and perform tests and prepare test reports, unless noted otherwise. The Contractor's Representative will perform visual inspection of all field welds in accordance with Section 6 of AWS D1.1, as applicable. The Contractor's Representative also may perform a visual receipt inspection of shop welds.

Contractor Inspection: The Contractor's Representative will perform surveillance to verify compliance of the work to the drawing and specifications.

Subcontractor-Supplied Testing:

Shop-Bolted Connections: Inspect in accordance with the specification for structural joints using ASTM A325 or A490 bolts.

Shop Welding: Certify welders and inspect and test during fabrication of structural steel in accordance with AWS D1.1 and AISC ASD specifications. Record types and locations of defects and work required and performed to correct deficiencies. As a minimum, visually inspect all welds according to requirements of AWS D1.1, Section 6, as applicable.

END OF SECTION 05100

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Section Title : **Vapor Barriers**
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SECTION 07190--VAPOR BARRIERS

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to, vapor barriers for:

Building systems exterior wall assemblies.

Furnish and install vapor barriers on the innermost interior insulation face in exterior walls and roofs of buildings as indicated for the ISB Injection Building. The vapor barrier shall be continuous over all interior surfaces, and all seams and penetrations shall be sealed.

Related Sections: The following sections contain requirements that relate to the work of this section:

Section 13120, "Metal Building Systems," for installation of vapor barriers in metal building system

REFERENCES:

The following documents, including others referenced therein, form a part of this section to the extent designated herein:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D774	"Standard Test Method for Bursting Strength of Paper"
ASTM D828	"Standard Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus"
ASTM D2020	"Standard Test Methods for Mildew (Fungus) Resistance of Paper and Paperboard"
ASTM E96	"Standard Test Methods for Water Vapor Transmission of Materials"

SUBMITTALS:

Submittals for Review: No vendor data are required for this section unless an "or-equal" item is proposed. "Or-equal" items require contractor approval prior to purchase.

Submittals for Information: None.

Submittals for Project Closeout: None.

PART 2--PRODUCTS

MATERIALS:

Vapor Barrier: The vapor barrier shall be a fiberglass scrim with reinforced white polypropylene backed by flame-retardant Kraft paper. The vapor barrier shall be a 2,805-PSK aluminum foil, as manufactured by Lamotite, a Division of Rexham Corporation, or approved equal. A matching pressure-sensitive tape

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shall be provided from the same company for sealing edges. The properties of the vapor barrier shall be as follows:

CONSTRUCTION

Aluminum Foil	0.0015 in.
Kraft	15 lb/ream _ 10%, white, flame retardant
Adhesive	Flame retardant
Tri-directional fiberglass	Machine Direction (MD) 4 in.
<u>Yarn reinforcing</u>	<u>Cross direction (XD) 4 in.</u>

TYPICAL PHYSICAL PROPERTIES

Permeance (MVTR) ASTM E96, Desiccant Method	
Perms, grains/hr-ft ² in. Hg	0.02
Puncture resistance – ASTM D4833	10 minimum
Tensile strength – ASTM D828 lb/in. width, avg.	40
Mullen burst strength – ASTM D774 P.S.I., avg.	65
Mold and mildew resistance – ASTM D2020	
Mold growth sustenance	No growth or organisms
Humidity resistance – 30 days at 95% RH/120°F	
Corrosion or de-lamination – 10 minimum	None
Dimensional stability – 15 min. at 200°F, percent length change, max.	0.25
Low-temperature resistance – 4 hr at 30°F	Remains flexible with no de-lamination
High-temperature resistance – 24 hr at 150°F	Remains flexible with no de-lamination

WEIGHT PER MSF, LB + OR - 5% 21

Underwriters' Laboratories Surface Burning Characteristics Classification:

<u>Facing</u>	<u>Foil Exposed</u>
<u>Kraft Exposed</u>	
20	5
35	5

PART 3--EXECUTION

INSTALLATION:

Seal the vapor barrier at seams, perimeter, obstructions, and penetrations with tape recommended by manufacturer. Wall vapor barrier shall be installed as described in description of work.

The roof vapor barrier shall be installed over the top of the purlins and down under the batt insulation, continuously over the entire roof surface. Adequate slack shall be provided to allow the batt insulation to

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1 completely fill the void between the roof purlins. No penetrations for structural struts or other materials
2 except when sealed with tape will be allowed.

3
4 FIELD QUALITY CONTROL:

5
6 The Contractor's Representative will perform surveillance to verify compliance of the work to the
7 drawings and specifications.

8
9 END OF SECTION 07190

Project Title: **ISB Injection System**
Section Title: **Thermal Insulation**
Revision Number: 0

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SECTION 07200--THERMAL INSULATION

PART 1--GENERAL

SUMMARY:

Extent of insulation work is shown on drawings, by note and/or symbol. All exterior walls and roofs shall be insulated whether specifically shown or not.

Section Includes: Work includes, but is not limited to:

- Foundation insulation
- Foundation skirting
- Blanket-type thermal building insulation for light-gauge framing
- Blanket-type thermal building insulation for metal building systems
- Roof insulation support system for metal building systems
- Rigid wall insulation.

Related Sections: The following sections contain requirements that relate to the work of this section:

Section 13120, "Metal Building Systems"

REFERENCES:

The following documents, including others referenced therein, form a part of this Section to the extent designated herein:

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C553	"Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications"
ASTM C578	"Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation"
ASTM C665	"Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing"
ASTM C1289	"Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board"
ASTM E84	"Standard Test Method for Surface Burning Characteristics of Building Materials"

SUBMITTALS:

Submittals for Review:

Submit copies of product data indicating compliance with the requirements of this section for approval prior to construction start.

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1 Submittals for Information:

2 None.

4 Submittals for Project Closeout:

5 None.

7 QUALITY CONTROL:

9 Thermal Conductivity: Thicknesses as shown are for thermal conductivity specified for each material.
10 Provide adjusted thickness as directed for equivalent use of material having a different thermal
11 conductivity. Where insulation is identified by "R" value, provide appropriate thickness.

13 DELIVERY, STORAGE, AND HANDLING:

15 General Protection: Do not allow insulation materials to become wet, soiled, or covered with ice or snow.
16 Comply with manufacturer's recommendations for handling, storage, and protection during installation.

18 PART 2--PRODUCTS

20 MATERIALS:

22 Unfaced Mineral-Fiber Blanket Insulation: Thermal/acoustical insulation combining mineral fibers
23 manufactured from glass, slag wool, or rock wool with thermosetting resins complying with ASTM C665,
24 "Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and
25 Manufactured Housing," Type I (blankets without membrane facing) or ASTM C553, "Standard
26 Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications;"
27 1.0 pcf minimum density; maximum thermal conductivity k-value of $0.27 F \times h \times ft^2/Btu$ at 75 F;
28 manufacturer's standard friction-fit lengths and widths as required to fill cavities formed by framing and
29 panel members.

31 Faced Mineral-Fiber Blanket Insulation: Thermal insulation combining mineral fibers manufactured from
32 glass, slag wool, or rock wool with thermosetting resins complying with ASTM C665, "Standard
33 Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and
34 Manufactured Housing," Type III, Class A (blankets with reflective vapor-retarder membrane facing and
35 flame spread of 25 or less) or ASTM C553, "Standard Specification for Mineral Fiber Blanket Thermal
36 Insulation for Commercial and Industrial Applications;" 1.0 pcf minimum density; maximum thermal
37 conductivity k-value of $0.27 F \times h \times ft^2/Btu$ at 75 F; with laminated vapor barrier membrane as specified
38 on one face; manufacturer's standard friction-fit lengths and widths as required to fill cavities formed by
39 framing and panel members.

41 Laminated Vapor Barrier for Faced Blanket Insulation: White metalized polypropylene/scrim/Kraft
42 membrane facing and flanges with white polypropylene on exposed insulation face. The vapor barrier
43 membrane shall be Lamotite 2805, by Rexam Corporation or approved equal. It shall have been tested by
44 Underwriter's Laboratories and shall possess ratings as follows:

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	<u>Flame Spread</u>	<u>Smoke Developed</u>
Kraft side exposed	10	30
Polypropylene side exposed	5	25

Roof Insulation Support System: The Roof Insulation Support System shall be "Insul Basket" as manufactured by IB, Inc., P.O. Box 9807, Madison, Wisconsin, 53715, phone (608) 257-7288, or approved equal. Units shall be designed for use with "Z" shaped roof purlins. All Insul Basket members shall be painted white. The Insul Basket shall be 8 in. deep and allow 9 in. of insulation to be installed below the metal standing seam roof with slight compression of the batts.

Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates. Use adhesive type recommended by manufacturer of insulation.

PART 3--EXECUTION

INSTALLATION:

General: Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

Install insulation that is undamaged, dry, unsoiled, and has not been exposed at any time to ice and snow.

Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.

Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise indicated or required to make up total thickness.

Unfaced Batt/Blanket Insulation: Install unfaced mineral-fiber blankets in cavities formed by framing members and wall panels. Use blanket widths, lengths, and thicknesses that fill cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends. Place blankets in cavities formed by framing members and wall panels to produce a friction fit between edges of insulation and adjoining framing members.

Insulation/Finish Board: On vertical surfaces, align joints over framing members and attach units with standard components, accessories, and fasteners in accordance with manufacturer's instructions for shiplap-taped application. On vertical surfaces, apply with the long dimension vertical.

Roof Insulation Support System: Install complete system, using manufacturer's standard components and accessories, to allow for full insulation thickness as indicated without compact insulation material.

Roof Insulation for Metal Building System: Install 6-in.-thick faced blankets in cavities formed by framing members on support system to produce friction fit between edges of insulation and adjoining framing members. Place blankets with facing down and facing flanges lapped over framing members; secure to produce airtight installation. Place unfaced second layer blankets of thickness to fill cavities over first layer with ends and edges staggered. Extend insulation layers into rake cavities.

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1 FIELD QUALITY CONTROL:

2

3 The Contractor's Representative will perform surveillance to verify compliance of the work to the
4 drawings and specifications.

5

6 END OF SECTION 07200

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SECTION 07901--JOINT SEALANTS

PART 1--GENERAL

SUMMARY:

Section Includes: Work includes, but is not limited to:

Seal exterior joints in vertical surfaces; and nontraffic horizontal surfaces as indicated below:

- Perimeter joints between building materials and frames of doors and windows
- Control and expansion joints in ceiling and overhead surfaces
- Other joints as indicated.

Seal exterior joints in horizontal traffic surfaces as indicated below:

- Control, expansion, and isolation joints in cast-in-place concrete slabs
- Joints between different materials
- Other joints as indicated.

Seal interior joints in vertical surfaces and horizontal nontraffic surfaces as indicated below:

- Control and expansion joints on exposed interior surfaces of exterior walls
- Perimeter joints of exterior openings where indicated
- Perimeter joints between interior wall surfaces and frames of interior doors and windows
- Perimeter joints of toilet fixtures
- Other joints as indicated.

Seal interior joints in horizontal traffic surfaces as indicated below:

- Control and expansion joints in cast-in-place concrete slabs
- Control and expansion joints in tile flooring
- Other joints as indicated.

Related Sections: The following section contains requirements that relate to this section:

- Section 09250, "Gypsum Drywall," for sealing concealed perimeter joints of gypsum board partitions to reduce sound transmission

SYSTEM DESCRIPTION:

Joint Sealants: Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous seals without causing staining or deterioration of joint substrates.

REFERENCES:

The following documents, including others referenced therein, form part of this section to the extent designated herein:

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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C719 "Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealant Under Cyclic Movement (Hockman Cycle)"
ASTM C834 "Standard Specification for Latex Sealants"
ASTM C920 "Standard Specification for Elastomeric Joint Sealants"
ASTM C1193 "Standard Guide for Use of Joint Sealants"
ASTM E90 "Standard Test Method for Laboratory Measurements of Airborne Sound Transmission Loss of Building Partitions and Elements"

SUBMITTALS:

Submittals for Review:

Product Data: Submit copies of product data from manufacturers for each joint sealant product required for approval prior to construction start.

Samples: Submit copies of samples for initial selection proposed in form of manufacturer's standard bead samples, consisting of strips of actual products showing full range of colors available, for each product exposed to view for approval prior to purchase.

Submittals for Information:

Certification: Submit copies of certification by joint sealant manufacturer that sealants plus the primers and cleaners required for sealant installation comply with local regulations controlling use of volatile organic compounds. Submit certification for information only prior to construction start.

Submittals for Project Closeout: None.

QUALITY CONTROL:

Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in material, design, and extent to that indicated for the project that have resulted in construction with a record of successful in-service performance.

Single-Source Responsibility for Joint Sealant Materials: Obtain joint sealant materials from a single manufacturer for each different product required.

DELIVERY, STORAGE, AND HANDLING:

Deliver Materials: Deliver materials to the project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multicomponent materials.

Store and Handle Materials: Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

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1 SITE CONDITIONS:

2
3 Environmental Conditions: Do not proceed with installation of joint sealants under the following
4 conditions:

5
6 When ambient and substrate temperature conditions are outside the limits permitted by joint sealant
7 manufacturer or below 40°F (4.4°C)

8
9 When joint substrates are wet.

10
11 Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than
12 allowed by joint sealant manufacturer for application indicated.

13
14 Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable
15 of interfering with their adhesion are removed from joint substrates.

16
17 PART 2--PRODUCTS

18
19 MATERIALS, GENERAL:

20
21 Compatibility: Provide joint sealants, joint fillers, and other related materials that are compatible with one
22 another and with joint substrates under conditions of service and application, as demonstrated by sealant
23 manufacturer based on testing and field experience.

24
25 Colors: Provide selections made by owner from manufacturer's full range of standard colors for products
26 of type indicated.

27
28 ELASTOMERIC JOINT SEALANTS:

29
30 Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing elastomeric sealants
31 that comply with ASTM C920, "Standard Specification for Elastomeric Joint Sealants," and other
32 requirements indicated on each Elastomeric Joint Sealant Data Sheet at end of this section, including
33 those requirements referencing ASTM C920 classifications for type, grade, class, and uses.

34
35 Additional Movement Capability: Where additional movement capability is specified in Elastomeric Joint
36 Sealant Data Sheet, provide products with the capability—when tested for adhesion and cohesion under
37 maximum cyclic movement in accordance with ASTM C719, "Standard Test Method for Adhesion and
38 Cohesion of Elastomeric Joint Sealant Under Cyclic Movement (Hockman Cycle),"—to withstand the
39 specified percentage change in the joint width existing at the time of installation and remain in
40 compliance with other requirements of ASTM C920, "Standard Specification for Elastomeric Joint
41 Sealants," for uses indicated.

42
43 Available Products: Subject to compliance with requirements, elastomeric sealants that may be
44 incorporated in the work include, but are not limited to, the products specified in each Elastomeric Sealant
45 Data Sheet.

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1 **TAPE SEALANTS:**

2
3 **Tape Sealant:** Manufacturer's standard, solvent-free, butyl-based tape sealant with a solids content that is
4 100% formulated to be nonstaining, paintable, and nonmigrating in contact with nonporous surfaces with
5 or without reinforcement thread to prevent stretch and packaged on rolls with a release paper on one side.
6

7 **Available Products:** Subject to compliance with requirements, tape sealants that may be incorporated in
8 the work include, but are not limited to, the following:
9

10 Pecora Corp., Extru-Seal Tape
11 Pecora Corp., Shim-Seal Tape
12 Protective Treatments, Inc., PTI 606
13 Tremco, Inc., Tremco 440 Tape
14 Tremco, Inc., MBT-35.
15

16 **JOINT SEALANT BACKING:**

17
18 **General:** Provide sealant backings of material and type that are compatible with joint substrates, sealants,
19 primers and other joint fillers; and are approved for applications indicated by the sealant manufacturer
20 based on field experience and laboratory testing.
21

22 **Plastic Foam Joint Filler:** Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips
23 of flexible plastic foam of material indicated below and of size, shape, and density to control sealant
24 depth and otherwise contribute to producing optimum sealant performance:
25

26 Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in
27 unruptured state.
28

29 **Elastomeric Tubing Joint Fillers:** Neoprene, butyl, EPDM, or silicone tubing, nonabsorbent to water and
30 gas, capable of remaining resilient at temperatures down to minus 32°F. Provide products with low
31 compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise
32 contribute to optimum sealant performance.
33

34 **Bond-Breaker Tape:** Polyethylene tape or other plastic tape as recommended by sealant manufacturer for
35 preventing sealant from adhering to rigid, inflexible joint filler materials or joint surfaces at back of joint
36 where such adhesion would result in sealant failure. Provide self-adhesive tape, where applicable.
37

38 **MISCELLANEOUS MATERIALS:**

39
40 **Primer:** Material recommended by joint sealant manufacturer where required for adhesion of sealant to
41 joint substrates indicated, as determined from preconstruction joint sealant-substrate tests and field tests.
42

43 **Cleaners for Nonporous Surfaces:** Chemical cleaners acceptable to manufacturers of sealants and sealant
44 backing materials, free of oily residues or other substances capable of staining or harming in any way
45 joint substrates and adjacent nonporous surfaces, and formulated to promote optimum adhesion of
46 sealants with joint substrates.
47

48 **Masking Tape:** Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent
49 to joints.

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1 PART 3--EXECUTION

2
3 EXAMINATION:

4
5 Examining joints indicated to receive joint sealants, with Installer present, for compliance with
6 requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant
7 performance. Do not proceed with installation of joint sealants until unsatisfactory conditions have been
8 corrected.

9
10 PREPARATION:

11
12 Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with
13 recommendations of joint sealant manufacturer and the following requirements:

14
15 Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant,
16 including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion
17 and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents,
18 water, surface dirt, and frost.

19
20 Clean concrete, masonry, unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by
21 brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a
22 clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles
23 remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed
24 air.

25
26 Remove laitance and form release agents from concrete.

27
28 Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with
29 chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of
30 interfering with adhesion of joint sealants.

31
32 Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant
33 manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to
34 comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant
35 bond; do not allow spillage or migration onto adjoining surfaces.

36
37 Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that
38 otherwise would be permanently stained or damaged by such contact or by cleaning methods required to
39 remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

40
41 INSTALLATION OF JOINT SEALANTS:

42
43 General: Comply with joint sealant manufacturer's printed installation instructions applicable to products
44 and applications indicated, except where more stringent requirements apply.

45
46 Sealant Installation Standard: Comply with recommendations of ASTM C1193, "Standard Guide for Use
47 of Joint Sealants," for use of joint sealants as applicable to materials, applications, and conditions
48 indicated.

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Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

Install joint fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

Do not leave gaps between ends of joint fillers. Do not stretch, twist, puncture, or tear joint fillers. Remove absorbent joint fillers that have become wet prior to sealant application and replace with dry material.

Install bond breaker tape between sealants where backer rods are not used between sealants and joint fillers or back of joints.

Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time that sealant backings are installed.

Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets, and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.

Provide concave joint configuration in accordance with Figure 5A in ASTM C1193, "Standard Guide for Use of Joint Sealants," unless otherwise indicated.

Installation of Preformed Foam Sealants: Install each length of sealant immediately after removing protective wrapping, taking care not to pull or stretch material, and to comply with sealant manufacturer's directions for installation methods, materials, and tools that produce seal continuity at ends, turns, and intersections of joints. For applications at low ambient temperatures where expansion of sealant requires acceleration to produce seal, apply heat to sealant in conformance with sealant manufacturer's recommendations.

PROTECTION:

Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so that installations with repaired areas are indistinguishable from original work.

FIELD QUALITY CONTROL:

The Contractor's Representative will perform surveillance to verify compliance of the work to the drawings and specifications.

CLEANING:

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- 1
- 2 Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with
- 3 cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.
- 4
- 5 END OF SECTION 07901